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Report No. 145.

[To accompany J. R. No. 42.]

HOUSE OF REPRESENTATIVES.

CANAL OR RAILROAD BETWEEN THE ATLANTIC AND PACIFIC OCEANS.

FEBRUARY 20, 1849.

Mr. JOHN A. ROCKWELL, from the Select Committee upon the subject, made the following

REPORT:

The Select Committee, to whom was referred a joint resolution to authorize the survey of certain routes for a canal or railroad between the Atlantic and Pacific oceans; also the memorial of the General Assembly of the State of Arkansas for the establishment of a national road from the western frontier of Arkansas to California; also the petition of George Wilkes in relation to the construction of a railroad to the Pacific ocean, and of certain citizens of Lancaster county, in the State of Pennsylvania, in aid of the petition of said Wilkes, report:

The recent acquisition of California, and the recognition and establishment of the right of the United States to the Oregon territory, render exceedingly important the question as to the best mode of communication with those immense possessions—the sea coast on the Pacific belonging to the Union, extending through 1,620 miles, and those territories, with the addition of New Mexico and Texas, including an area of 1,193,061 square miles, equal to 763,559,040 acres. The means of an easy and rapid communication between the two oceans has heretofore been a subject of great interest to the United States in common with all civilized nations. It has now become a matter of the utmost practical importance, and the duty and necessity of uniting the remote and extended possesions of the country, is most obvious and undeniable.

The various modes of communication which have been heretofore presented to the consideration of Congress and the country

are all entitled to most careful consideration; and only those should be adopted which are, by thorough examination, not only ascertained to be practicable, but, on comparison with all the routes proposed, to be the very best.

Until quite a recent period, the attention of the civilized commercial nations of the earth has been directed mainly to the various communications across the Isthmus between North and South America. The object of Columbus himself, as it is well known, the motive which led him to embark in his voyage of discovery, was to discover the easiest passage to China. On his fourth and last voyage, for which he left Cadiz on the 11th May, 1502, and returned on the 7th November, 1504, he examined the isthmus, but never with his own eyes saw the Pacific ocean. That honor was reserved to Vasco Nuñez Balboa, one of the most remarkable men which Spain produced, fertile as it was in heroes worthy of the admiration of mankind. He discovered the Pacific, September 25, 1513. Before this time, from the year 1505 to 1507, in order, as they expressed it, to discover the *secret of a strait*, the Spanish court fitted out a large expedition, which departed 29th June, 1508; and in 1515, Juan Diaz de Solis received orders to proceed to the south, in order to pass to the Pacific through the strait which they supposed to exist.

Expeditions, also, were fitted out for the same purpose by the Portuguese, who were no less enterprising than the Spaniards, in 1501, 1502, and 1520.

About this time, Cortez was achieving his conquest of Mexico. During his friendly interviews with Montezuma, he inquired of the prince in relation to the *secret of a strait*? and accompanying a despatch from him to Charles V., of 30th Oct., 1520, he forwarded a chart of the coast furnished by the Aztec emperor, embracing the Hoasacoalco. Although no strait was discovered, he stated that the isthmus was narrow, and a communication could easily be made from sea to sea by the Goasacoalco and the Chimalapa. Extensive works were also, about this time, constructed by the Spaniards at Tehuantepec.

In 1551, Lopez de Gomaro, author of a history of the Indies, proposed the union of the two oceans at three points, which are precisely the same as now principally occupy the attention of the civilized world, viz: Chagres, Nicaragua, and Tehuantepec; but Philip II., instead of pursuing these splendid enterprises, wasted his resources in the vain effort to extend his power in Europe. The committee refrain from giving, in detail, the narration of these early voyages, although in the highest degree interesting. They fully justify the language of a distinguished British statesman: "When the Spanish discoverers first overcame the range of mountains which divide the western from the Atlantic shores of South America, they stood fixed in silent admiration, gazing on the vast expanse of the southern ocean, which lay stretched before them in boundless prospect. They adored—even those hardened and sanguinary adventurers adored—the gracious providence of Heaven

which, after a lapse of so many centuries, had opened to mankind so wonderful a field of untried and unimagined enterprise."

From this early period to the present time, the attention of the principal nations of Europe has been, at intervals, directed to the opening of some communication between the two oceans, and yet it is a remarkable fact that, to this hour, there has not been such a survey of any of these routes as will enable any one to arrive at definite results, as to the practicability or expense of the construction of a canal or railroad across the isthmus at any one of the points to which public attention has been principally directed, although the recent surveys of two or three routes have been of a truly scientific character, and contain much valuable information.

This important subject has at different times occupied the attention of the government of the United States. The Senate, on the 3d March, 1835, adopted the following resolution:

"*Resolved*, That the President of the United States be respectfully requested to consider the expediency of opening negotiations with the governments of other nations, and particularly with the governments of Central America and New Grenada, for the purpose of effectually protecting, by suitable treaty stipulations with them, such individuals or companies as may undertake to open a communication between the Atlantic and Pacific oceans, by construction of a ship canal across the isthmus which connects North and South America, and of securing forever, by such stipulations, the free and equal right of navigating such canal to all such nations on the payment of such reasonable tolls as may be established, to compensate the capitalists who may engage in such undertaking to complete the work."

In pursuance of this resolution, President Jackson employed Mr. Charles Biddle, "for the purpose of making inquiries into the present state of the projects for uniting the Atlantic and Pacific oceans through the isthmus of Darien;" and, through the Secretary of State, Mr. Forsyth, gave ample instructions as to the mode of proceeding in discharging the duty assigned him, and also furnished Mr. Biddle with letters to the diplomatic agents and consuls of the United States in Mexico, Central America, and New Grenada, directing them to aid him in the prosecution of the objects of his mission.

The results of these investigations will be found in a report of the Committee on Roads and Canals, made to the House of Representatives March 3, 1839.

That report was made by the committee in relation to a petition of sundry citizens of New York and Philadelphia, "praying the aid of the government of the United States in procuring the construction of a ship channel or navigable canal across the isthmus between North and South America." It is an exceedingly full and valuable document, and embraces a large amount of useful information. It concludes with recommending the adoption of the following resolution:

"*Resolved*, That the President of the United States be requested to consider the expediency of opening or continuing negotiations

with the governments of other nations, and particularly with those the territorial jurisdiction of which comprehends the isthmus of Panama, and to which the United States have accredited ministers or agents, for the purpose of ascertaining the practicability of effecting a communication between the Atlantic and Pacific oceans, by the construction of a ship canal across the isthmus; and of securing forever, by suitable treaty stipulations, the free and equal right of navigating such canal to all nations on the payment of reasonable tolls."

This report is appended hereto, as is also a large amount of useful information, derived from various other sources, in relation to the subject referred to this committee.

On the 24th February, 1846, a resolution passed the Senate directing the Secretary of State to communicate to that body "any despatch or information he may have received from either of the ministers of the United States abroad, on the subject of a ship canal across the isthmus of Panama, and of opening new channels of communication with the eastern nations." In pursuance of that direction, the present Secretary of State, on the 11th May, 1846, communicated to the Senate a number of valuable papers, including one at considerable length on this subject, from Mr. Wheaton, our minister at Prussia. This document is also reprinted with this report.

It will thus be seen that the attention of the government of the United States has been repeatedly called to this subject, although at the time there did not exist the very strong reasons which the recent acquisition of immense possessions on the Pacific now furnish for opening a communication with that ocean.

In addition to the various routes across the isthmus, there have been presented to Congress, and in various forms to the public, of a more or less definite character, numerous propositions in relation to communications across the continent, commencing at different points on Lake Michigan, the Mississippi river and its branches, and the Gulf of Mexico, to several points on the Pacific ocean. Memorials in relation to some of these routes have been referred to this committee.

The committee are not prepared to say to what extent, if at all, the aid of the government of the United States should be rendered to these various projects, or any of them. As, however, in the present great want of accurate knowledge in relation to most of these routes, it is not possible to determine which is the most desirable for the United States, and should receive the aid of the government, the committee have deemed it important that full and accurate surveys should be made of the different routes, as being entirely essential to an intelligent consideration and decision of the question.

Without, therefore, expressing any decided opinion as to the course which ought to be eventually pursued in relation to any of these different routes, they have thought that they could best discharge the duty assigned them by collecting and presenting, in a distinct form, the information within their reach, in relation to all

the principal routes between the two oceans, to which public attention is now directed.

In relation to the communications across the isthmus, five points named by Humboldt are as follows:

1. The isthmus of Panama.

2. The isthmus of Nicaragua, between the lake of that name, forming the sources of the Rio San Juan, which falls into the Atlantic ocean, and the gulf of Papagayo, on the Pacific.

3. The isthmus of Tehuantepec, between the sources of the Rio Chinalapa, which fall into the Pacific ocean, and the Rio del Passo, which falls into the Goasacoalco; which last empties into the Atlantic.

4. The isthmus of Darien or Cupica.

5. The isthmus between the Rio Atrato, which falls into the Atlantic ocean, and the Rio Choco, which falls into the Pacific.

Humboldt suggests other points as being worthy of examination, but it is not important to consider those, as subsequent investigations seemed to narrow down the inquiry to those above named, and especially to the three isthmuses of Panama, Nicaragua, and Tehuantepec.

In relation to the nature of the communication, which should be opened between the two oceans, the question arises between a railroad, a ship canal, and a canal of ordinary dimensions. The last named would, it is apparent, be of little value compared with the expense of construction. The difficulty attending the supply of water, which, in common with a ship canal, would, to a very great extent, enhance the expense of the work; the difficulty and expense of preserving the banks from being washed and torn away by the torrents of rain, which, during a portion of the year, deluge the country; the other numerous objections to canals of this class, wherever they exist, for the transportation of passengers, as compared with railroads, and the necessity of transhipment of merchandise, all combine to decide the question against any work of this character.

Some of the same objections, especially the latter, apply to a railroad; but between these two modes of communication there cannot be a doubt but that a railroad is most to be preferred.

The necessity of transhipment is, however, a most serious objection to both these modes of communication, and it is quite apparent that they both fall very far short of what is really required by the commercial world. A ship canal of large dimensions, sufficiently capacious to admit vessels of at least 1,200 tons burden, is what has long been desired, and if accomplished, would lead to commercial changes of the most important and useful kind. It would seem, however, that a work of this stupendous character, and requiring so much time and money, should not prevent the construction in the meantime of a railroad at some suitable point, which would, instead of being a substitute for a ship canal, be found to be a most valuable auxiliary.

The only work of this character is the Caladonian canal, which Humboldt speaks of as the most magnificent hydraulic work hitherto

undertaken. This is in the strictest sense an oceanic canal. It unites the eastern and western seas of Scotland. The navigable part is about 51 miles, of which about 19½ is of artificial construction. It was 16 years in building; admits passage of 32 gun frigate. It is 18 feet 8 inches in depth; breadth at the bottom is 47 feet. There are 23 locks 150 feet in length by 37 feet wide.

A consideration of the nature of the business proposed to be directed to the isthmus route must show the value of such a work, and its absolute necessity, in order to secure a large part of that business.

The committee doubt exceedingly whether the ships engaged in the whale fisheries from the ports in the United States, would, to any considerable extent, avail themselves of a railroad or boat canal across the isthmus, or would be diverted thereby from their present course. Such is supposed to be the opinion of those engaged in this fishery, and as the committee think for very just reasons.

Nor would there be any extensive trade carried on from England to China by this isthmus route if a transhipment at the isthmus should be necessary. It is, indeed, a matter of serious doubt how far, by the aid of a ship canal, this trade could be diverted from its present channels. It is by no means certain that there would be any saving of distance by taking this way from London to Canton.

Humboldt states the distance from London to Canton via Cape of Good Hope, at 4,400 marine leagues, by Cape Horn at 5,800, and by canal, at the isthmus of Nicaragua, 4,800 marine leagues.

Chevalier, in his valuable treatise on the isthmus of Panama, says that from Havre or London to Canton around the Cape of Good Hope, crossing the line twice, is 24,500 kilometers, or 15,225 miles; by the isthmus of Panama 27,000 kilometers, or 17,290 miles, that is in straight lines; the distance actually travelled being from one-quarter to one fifth more in both cases.

Professor Trittich, of London University, furnished to Prince Louis Napoleon, for his work in relation to the canal across the isthmus by lake Nicaragua, published in 1846, a statement of the distance and length of numerous voyages, from which the committee take the following:

From England to Canton, via Cape of Good Hope, during the season of the south-west monsoon, 15,590 miles, 137 days; via the proposed canal, 15,878 miles, 120 days.

From England to Canton, via Cape of Good Hope, during north-east monsoon, 16,880 miles, 175 days; via proposed canal, 15,838 miles, 111 days.

Homeward voyage from Canton to England via proposed canal, during south-west monsoon, 14,558 miles, 129 days; via Cape of Good Hope, 14,940 miles, 130 days. Homeward voyage via Cape of Good Hope, during north east monsoon, 13,330 miles, 107 days.

The following tables by Lieut. Maury are taken from the Report of the Committee on Naval Affairs at the present session, and pre-

sent the view of that scientific officer as to the length of these various routes:

The following table shows the sailing distances from New York and Liverpool to the principal ports beyond or around Cape Horn and the Cape of Good Hope.

	From Liverpool.	From New York.
	Miles.	*Miles.*
To Calcutta via Cape of Good Hope	16,000	17,500
Calcutta via Cape Horn	21,500	23,000
Canton via Cape Horn	20,000	21,500
Canton via Cape of Good Hope	18,000	19,500
Valparaiso via Cape Horn	11,400	12,900
Callao via Cape Horn	12,000	13,500
Guayaquil via Cape Horn	12,800	14,300
Panama via Cape Horn	14,500	16,000
San Blas via Cape Horn	16,300	17,800
Mazatlan via Cape Horn	16,500	18,000
San Diego via Cape Horn	17,000	18,500
San Francisco via Cape Horn	17,500	19,000

Table showing the saving of time from New York, by the new route via the Isthmus of Panama, as compared with the old routes via Cape Horn and the Cape of Good Hope, to the places therein named, estimating the distance which a common trading ship will sail per day to be one hundred and ten miles, and calculating for the voyage out and home.

	Distance via Cape of Good Hope.	Length of passage out and home.	Distance via Cape Horn.	Length of passage out and home.	Distance via Isthmus of Panama.	Length of passage out and home.	Saving via the isthmus over the route via Cape of Good Hope, out and home.	Saving via the isthmus over the route via Cape Horn, out and home.
	Miles	*Days.*	*Miles.*	*Days.*	*Miles.*	*Days.*	*Days.*	*Days.*
To Calcutta	17,500	318	23,000	418	13,400	244	74	174
Canton	19,500	354	21,500	390	10,600	192	162	198
Shanghae	20,000	362	22,000	400	10,400	188	174	212
Valparaiso	.....	.....	12,900	234	4,800	86	.....	148
Callao	.....	.....	13,500	244	3,500	62	.....	182
Guayaquil	.....	.....	14,300	260	2,800	50	.....	210
Panama	.....	.....	16,000	290	2,000	36	.....	254
San Blas	.....	.....	17,800	322	3,800	68	.....	254
Mazatlan	.....	.....	18,000	326	4,000	72	.....	254
San Diego	.....	.....	18,500	336	4,500	82	.....	254
San Francisco	.....	.....	19,000	344	5,000	90	.....	254

Mr. J. H. Alexander, of Baltimore, an engineer of high reputation for scientific attainments, has also furnished to this committee at length, a statement of facts and estimates, and his own opinions in relation to the same, which is appended at length to this report, and to which the committee will have occasion again to refer in this report.

The following table is contained in his statement:

Table of average and proportionate distances by several routes.

No.	Route.	Length equated for difference of level.	Mean distance to Canton, forth and back.		Proportionate advantage.		Resulting proportion.
			From London.	From N. York	European.	American.	
		Miles.	*Miles.*	*Miles.*			
8	Through Panama	46	15,054	12,624	0.979	1.161	1.14
11	Do....Lake of Nicaragua..	130	14,666	12,298	1.005	1.192	1.20
13	Do....Tehuantepec.....	147	13,895	11,655	1.061	1.258	1.33
14	Do....San Diego	2,935	13,750	10,550	1.072	1.390	1.49
15	Do....Mouth of Columbia..	3,534	13,272	11,072	1.111	1.324	1.47
	Do....Cape of Good Hope..	.....	14,741	14,659	1.000	1.000	1.00

From these various statements, although widely different, it is quite apparent that the European trade with China and the East Indies would most certainly not pass by the Isthmus, unless there should be a ship canal of such dimensions as to allow the ships engaged in that trade to pass through without discharging their cargoes; and probably it would be long before the direct trade between Europe and China would seek this channel even if a ship canal were completed.

The trade from the ports of the United States with China would doubtless be through such a canal when constructed; but the committee are of opinion that even that trade would not soon be diverted from its present course in case a transhipment should be necessary at the Isthmus.

There is a diversity of statement as to the comparative distance from Boston or N. York to Canton by the proposed canal and by the present voyage. Humboldt makes the difference only 300 marine leagues less, and Chevalier makes the difference 1,700 kilometres, or 1,056 miles. But if the difference were three or four times as great as is stated by these authors, there would be but little motive for encountering the expense and hazard of transhipment, and the adoption of an entirely new mode of conducting the trade, and the expenses of agencies, warehouses, &c., at the Isthmus, in order to save a few days or even weeks in a voyage.

The committee enlarge more on this branch of the subject, not merely to show the superior importance eventually of a ship canal, but to show the utter absurdity of many of the calculations made in relation to other projects for railroads across the continent, and

the support to be expected from the business of remote regions of the world.

There are many other views of a general character connected with this subject, which might be presented; but the committee hasten to present the facts in relation to the three points above referred to under distinct heads.

1. The isthmus of Panama.

This route is from Chagres, at the mouth of Chagres river, or Limon bay, called also Puerto de Naos, (Navy bay,) within two and a half miles of Chagres river, to Panama, a distance of about fifty miles. Chagres has a harbor for vessels drawing no more than ten to twelve feet of water. A bar or ledge of rocks extends across its entrance. Panama, in 8° 30′ north latitude, and 79° 30′ north longitude, is built on a neck and point of land which extends into the bay. There is no town of any importance in the interior. Cruces, on the Chagres, said to contain about 2,000 inhabitants, who live in miserable huts, is the entrepot where goods are put on board of boats to be brought down to Chagres. From Panama to Cruces they are conveyed on mules, a distance of about twenty miles.

The insalubrity of the climate is urged against this route for a canal. There are only two seasons—the dry season, or summer; and the rainy season, or winter. The first begins with the last part of December, and lasts till April; the second follows in April, and continues until December. In those parts which are most advantageously situated, as in the city of Panama and its neighborhood, rain begins to fall in April, and May and June are rainy months. In July, August, September, and October, it rains incessantly. In November rain seldom falls, except during night. The weather usually clears up in December. Rain scarcely ever occurs during the months of January, February, and March.

Panama has excellent and deep harbors.

In relation to the harbor at Chagres, the bar at the mouth of the river is a serious impediment to its navigation. Vessels of large size cannot, unless the bar is removed, enter the harbor. It appears, from a number of surveys, that Limon bay is a good harbor, and suited for vessels of a large class. Two maps accompanying this report—one from the survey conducted by Mr. Lloyd, in 1828, 1829, by order of General Bolivar, and the other by Garella, in connexion with his very recent survey—give the soundings of this bay, and furnish the best means of judging of its character as a harbor.

The following is the statement in Garella's report:

"*Termination on the Atlantic.*—The bay of Limon, sometimes called in Spanish 'Puerto de Naos,' situated five miles to the northeast of the mouth of the river Chagres, is of considerable extent. Its entrance is 4,375 yards wide; its length north and south is 6,560 yards; and its average width, which is quite regular, is 3,281 yards. Its depth is considerable everywhere, except its

southern extremity, where it is occupied by a flat covered with cocoa nut trees. In the middle of the entrance there is 36 feet of water. In the middle of the bay there is from 23 to 27 feet of water. The bottom is of mud and muddy sand, affording good anchorage. Everything tends to make it an excellent port, except its exposure to the winds from the north, northeast, and northwest, which usually prevail, and sometimes with violence, in this part of the sea of the Antilles. The form of the coast, which tends to the northeast, affords the best protection to the west shore of the bay; which shore also has the greatest depth of water. These circumstances have induced me to make the termination of the canal or railroad on that shore of the bay, near the middle of its length, and a little inside of a small ravine, called Cano de los Colorados. In order to make a good harbor at this point, a mole, placed at the extremity of a promontory which is within the ravine, will be required to be extended into the bay 3,280 feet, where there is a depth of 29½ feet of water."—*Pp.* 93, '4.

"*Termination on the Pacific.*—The coast of the Pacific ocean, on account of the great rise and fall of the tides, does not present as favorable a point for the creation of a harbor as the bay of Limon. There is one favorable circumstance, however, which is its situation in the bottom of the Gulf of Panama, which makes part of that zone of the great ocean which has assigned to it the name of Pacific, and which by its position, re-entering within the land, insures a much greater tranquility of its waters. This circumstance, joined to the vicinity of the isles of Tarboga and Tabogulla, situated only seven and a half miles from the small bay of Vaca de Monte, [the proposed terminus,] islands where there is a good harbor and good anchorage for the largest vessels, would preclude the necessity, for a length of time at least, of the execution of any work intended for the protection of the termination against the rare and short tempests of those regions.

"The small bay of Vaca de Monte is nearly semi circular, with an opening of 380 yards. By soundings made the 4th of July, 1844, [two days after the high tide of the full moon on the 30th of June,] 11½ feet of water at low tide was found in the middle of the entrance; 9.8 feet almost every place across the entrance; 8.8 feet in the middle of the entrance; and 11½ to 13 feet at a hundred yards from the shore. The tide of the 4th of July being estimated at 15.74 feet in heighth, the foregoing heighths would become, at half-tide, 19.37 and 17.67 at the entrance, 16.60 in the bay, and 20.80 one hundred yards outside. A causeway extending 2,000 feet into the sea would give an additional depth of water of at least 10 feet."—*Pp.* 95, '6, '7.

In the map of Mr. Lloyd it is incorrectly stated that the soundings in Limon bay are in feet; they were actually in fathoms, and so are the figures on the map.

Although examinations were made at this point at a very early period, it is a remarkable fact that, until very recently, very little

useful or reliable information was furnished; and at this moment a thorough and minute survey of various lines across the isthmus, at and near these two points, Chagres and Panama, is exceedingly desirable.

As early as the year 1528, a survey was made by Spanish engineers, under the direction of the court of Madrid, for the establishment of a water communication across the isthmus by the river Chagres. They intended to commence the artificial canal at Cruces, and conduct it thence to Panama.

Subsequently to this, at different periods, by the statements of travellers and others, the attention of the civilized world was called to this important subject; but it was not until the survey of Mr. Lloyd, in 1828–'9, above referred to, that anything worthy of the name of a survey had been made of this line.

Prior to that time it had been assumed that there was a considerable difference in the elevation of the water in the two oceans; and, what is very remarkable, this supposed difference of elevation was regarded as a very serious difficulty, if not an insurmountable one, to the construction of a canal between the two oceans. It is scarcely necessary to say that, as there was confessedly a very considerable elevation to be overcome between the two oceans, requiring a number of locks, if this difference had existed it would have furnished no impediment to the prosecution of the work. The accurate surveys of Mr. Lloyd furnished the first really correct information on this subject.

The account of this survey is contained in an article communicated to the Royal Society in November, 1829, and contained in the 122d volume of their transactions; and, as it presents much useful information, is appended to this report.

The following are the results of his examinations in relation to tides and comparative height of the waters in the two oceans:

"By careful and continued observations, I found the rise and fall of the tide in the Pacific, at Panama, as follows: between the extreme elevation and depression of the waters by occasional tides, there is a difference of 27.44 feet, and the mean actual rise and fall two days after full moon is 21.22 feet."

"At Chagres, I observed the rise and fall of the tide at the close of the dry season, in April, 1829, to be 1.16 foot, and being there subsequently during the rainy season, I had an opportunity of observing that the high water mark was the same in both seasons.

"The high water mark is nearly the same at Chagres and at Panama, namely, at 3h. 20m. at full and change. Hence the following interesting and curious phenomena are deducible in reference to the difference of level of the two seas:

"First. High water mark at Panama is 13.55 feet above high water mark of the Atlantic at Chagres; half the rise and fall of spring tides is, at Panama, 10.61 feet, and at Chagres 0.58 of a foot; and assuming half the rise and fall above the low water of spring tide to be the respective mean levels, the mean height of the Pacific at Panama is 3.52 feet higher than that of the Atlantic at Chagres.

"Second. At high water—the time of which is nearly the same on both sides the isthmus—the Pacific is raised at mean tides 10.61 feet, and the Atlantic 0.58 of a foot above their respective mean levels; the Pacific is, therefore, the highest at such times by (10.61 — 0.58 + 3.52 =) 13.55 feet.

"Third. At low water both seas are the same quantities below their respective mean levels; therefore, at such times the Pacific is lower than the Atlantic by (10.61 — 0.58 — 3.52 =) 6.51 feet.

"In every twelve hours, therefore, and commencing with high tides, the level of the Pacific is first several feet higher than that of the Atlantic; it becomes then of the same height, and at low tide is several feet lower. Again, as the tide rises, the two seas are of one height; and finally, at high tide, the Pacific is again the same number of feet above the Atlantic as at first."

The following is from Garella's report:

"By careful leveling it was ascertained that the highest tides in the Pacific at Panama, are 19.09 feet above the highest tides in the Atlantic at Chagres. As the highest tides of the Pacific are 20.01 feet, whilst those of the Atlantic at Chagres are but 1.31 feet, the difference of the levels, at the lowest tides, would be reduced to 0.39 feet. By the above figures, the mean level of the Pacific would be 9.74 feet above that of the Atlantic; but the mean level of the Pacific not being constant, a mean of the observed tides has been taken, which gives 9.54 feet as the difference of height between the mean levels of the two oceans." Page 80.

In relation to the harbor at Chagres, Mr. Lloyd further remarks: "It is subject to one great inconvenience, that vessels drawing more than twelve feet of water cannot enter the river, even if perfectly calm weather, on account of a stratum of slaty limestone which runs at a depth, at high water, of fifteen feet from a point on the main land to some rocks in the middle of the entrance of the harbor, and which are just even with the water's edge; which, together with the current which sets on the southern shore, particularly in the rainy season, renders the entrance exceedingly difficult and dangerous.

"The value of the Chagres, considered as the port of entrance for all communications, whether by the river Chagres, Trinidad, or by railroads across the plains, is greatly limited from the above mentioned cause. It would prove in all cases a serious disqualification, were it not one which admits of a simple and effectual remedy arising from the proximity of Limon, otherwise called Navy Bay, with which the river might easily be connected. The coves of this bay afford excellent and secure anchorage in its present state, and the whole harbor is capable of being rendered by obvious and not very expensive means, one of the most commodious and safe harbors in the world."

Accompanying the report of Mr. Lloyd was a map of the Chagres river, with the soundings; but this map has not been published, nor do the maps accompanying the paper read before the Royal Society give the levels of the two rivers surveyed by him. The greatest elevation on one of the lines surveyed by him was 633 32-100 feet, and the point where his line struck the Chagres river was

169 84-100 feet above the level of high water mark in the Pacific. At Cruces the surface of the water in the river Chagres was only 37 96 100 feet above the Pacific.

In the year 1844 the French government, in order to ascertain the practicability of a ship canal between the two oceans, employed M. Garella, a distinguished engineer who had been previously engaged in operations in the Pyrenees, who was furnished with all the necessary aids for the accomplishment of the important objects of his mission.

The results of this survey were communicated to M. Guizot, in May, 1845, and have been since published, and from it we have already quoted. The most valuable portion of this survey is appended to this Report.

Mr. Wheaton remarks:

"One of the most important objects to which the attention of M. Garella had been directed by his instructions, was to ascertain how far the Cordillera of the Andes, which has been supposed to run in an uninterrupted chain throughout the two American continents, from Cape Horn to the Arctic ocean, is in fact broken off or declines and disappears at any point of the isthmus connecting the two continents. The trigonometrical observations of the French engineers, which appear to have been made with great care and accuracy, result in demonstrating, that in the country lying between Porto Bello and Panama, a considerable depression occurs in the cordillera, the lowest point of which is from 120 to 160 metres above the level of the sea. In other parts it continues to rise from ten to twenty times higher. M. Garella, therefore, concludes that the summit level to be overcome would not present an insurmountable obstacle to the construction of a canal of ordinary dimensions, such as those which have been carried over the same elevation both in Europe and in America. But the problem to be resolved was the construction of a ship canal between the two seas, three times as long and four imes as deep as the canals called in France *à grande section*, with the aid of locks on a scale of similar proportion.

"To feed a canal, of whatever dimensions, water is necessary; and the next object to which the inquiries of M. Garella were directed, was to ascertain the means of supplying with water a canal of such vast dimensions. For this purpose he guaged the river Chagres, the only source of supply, and ascertained that by means of two lateral canals (*rigoles*) the necessary supply of water might be obtained. But in order to make this source of water available for the use of the canal, it is indispensably necessary that the summit level between the two seas should be brought much lower than the present surface of the land at its lowest point of depression. Instead of 120 or 160 metres of elevation, it must be reduced to 50 or 60 metres. Should the summit level remain at the former elevation, it is evident that the number of locks necessary to overcome it would be multiplied to such a degree as to render the navigation with large vessels very difficult, if not quite impossible. In order to meet this difficulty, a choice must be made between two

means which present themselves. These are, a deep cut and a tunnel. It is believed that no example exists of such a cut being effected in solid rock, and M. Garella therefore gives the preference to the other alternative of a tunnel. He was not deterred by the unexampled magnitude of this tunnel, far transcending any similar work of the Etruscan kings of Rome, or which the more perfect science of the modern engineer has hitherto accomplished. The vault of a tunnel to be traversed by an oceanic canal bearing ships of 1,200 tons, must be at least 30 metres above the level of the water. The idea of such a tunnel has been hitherto rejected by all those who have studied the question; but the engineer employed by the French government, after a careful examination of the geological features of the country, does not hesitate to pronounce its execution to be practicable, at an expense of not exceeding forty-four millions of francs. The passage between the mountains (*le col*) through which he deems it expedient to direct the canal, is that of Ahogayegua, at the height of 140 metres above low water mark. The level which he adopts for the summit level would be 41 metres above the sea, and consequently 99 metres above the surface of the ground. In order to gain this level for the basin between the two divisions of the canal, the tunnel must be extended to the length of 5,350 metres. It would then require *only* eighteen locks on one side, and sixteen on the other, whilst an ample supply of water would be thus secured."

The following is the statement of Garella as to the general route of the railroad, about forty-six miles long, and the estimate of the expense and the means of execution:

"*General route of railroad—about forty-six miles long.*

"Starting from the bay of Vaca de Monte, on the Pacific, and running north-westerly until the valley Caimito is reached; up this valley; cross the Aguacata with a single arch; up the valley of the Bernadino; cross the dividing ridge at Ahagayegua point by a tunnel 19,848 feet in length, the highest point of the road being 2,460 feet from the northern extremity of the tunnel, 196.85 feet above highest water at Panama, and 262 55 feet below the highest point of the dividing ridge between the two oceans; then down the valley of the Bonito on its right bank; cross the Caño Quebrado about 2½ miles above its entrance into the Chagres; down the valley of the left bank of the Chagres; cross the Trinidad about 2,000 feet above its mouth; descending the valley of the Chagres, cross it three times—first at the village of La Bruja, from left to right—secondly, 2,850 feet lower down, from right to left—and thirdly, at Miraflores, from left to right; cross the Gatun on the right bank of the Chagres, about 500 feet above its confluence with that river; up the valley of the Gatun until you clear some heavy spurs; then sweep round northerly to Limon bay, down its western shore to to the point of termination near the Caño de los Colorados. The three passages of the Chagres would each require a viaduct of 230 feet; that of the Trinidad, of 148 feet, and that of the river Gatun,

one of 115 feet in length. All the other streams throughout the route are small, and can be readily crossed with single arches.

"*Estimate of cost—double track—one track through tunnel.*

"For a tunnel 19 feet 8 inches wide, and 18 feet high, at $2 29 per cubic yard, equal to $90 04 per running yard—Length of tunnel, 6,616 yards, at $90 04	$595,704 64
Grading, largely estimated as averaging 16.40 feet, with a cross section of 760 square feet, at $0 23 per cubic yard, 6,220,000 cubic yards, at 23 cents	1,430,600 00
3 viaducts across the Chagres, each of 230 feet, at $40,000	120,000 00
1 viaduct across at Trinidad, 148 feet long	30,000 00
1 viaduct across at Gatun, 115 feet long	24,000 00
3 viaducts, of one arch each, across the Aguacata, Copé, and Caño Quebrado, from 40 to 50 feet in length, at $10,000 a-piece	30,000 00
10 small bridges, at $30,000	30,000 00
Rails, [60 pounds to the yard,] superstructure, crossties, spikes, &c., &c., discharging cranes, &c.	1,575,280 00
Mole at Limon bay	1,013,600 00
Mole at Vaca de Monte bay	865,300 00
Locomotives, wagons, cars, &c., &c	400,000 00
Storehouses, shops, stopping places, &c., &c	380,000 00
Entire cost of railroad	$6,494,484 64

"*Estimate of the wages of workmen per man.*

"Daily pay of laborer, with shovel or pickaxe	$0 60
" " as a miner	1 00
" " as a quarryman	1 00
" " as a mason	1 00
" " as a mortar carrier, &c	0 50
" " as chief of wheel-barrow men, gang of	0 75
" " as wheel-barrow man	0 50
" " as stone cutter	1 50
" " as a carpenter	1 50
" " as a black or white smith	1 00

"*Means of execution.*

"That part of the isthmus which belongs to Granada is thinly inhabited; but a sufficient number of laborers, such as diggers and other low rank of workmen, could be obtained from that and the neighboring countries, who would have the advantage of being acclimated, and who, under careful task masters or "bosses," would very soon become sufficiently expert in the use of the spade, shovel, pickaxe, &c., &c. All the masons, carpenters, bricklayers, and other master workmen, would have to come from the United States,

and could carry on their work during the rainy months, from June to November, under tents, sheds, &c., suitably located. To induce this kind of necessary emigration, it might be advisable to give each of the better class of mechanics a certain quantity of land taken from that which the Granadian government would readily grant to any responsible company executing the work; and thus the nucleus of a thriving permanent population would be formed.

"The immense herds of cattle scattered through the isthmus, and now killed only for their hides, with the extraordinary fertility of the soil on the large savannas, meadows, &c., where, in eight months, magnificent fields of corn, rice, bananas, and sugar cane, could be grown, puts the cheap feeding of the large body of men required for such an undertaking beyond a doubt; in addition to which, the contract with a former company [now declared null and void] gave free entry to all supplies, and the same privilege would doubtless be again granted to a company formed with the ability and determination to carry to completion this magnificent plan of intercommunication between the two oceans."—Pp. 160-1-2.

It has been recently stated in the public press, that a late official letter from Brevet Major Fitzgerald, written at Panama, says:

"The road from Cruces to Panama crosses, besides the dividing ridge between the two oceans, diagonally, a number of spurs jutting out therefrom on each side. These spurs are of rock and very precipitous.

The road as you pass up between two of these spurs presents the appearance of the bottom of a ravine filled with large loose stones and the debris of the adjacent hills, and, where it crosses the spur, that of a sucession of stairs, up and down, with a hole in each step about three inches deep, worn by the feet of the animals in passing over, into which your horse or mule inserts his foot, and you cannot make him place it anywhere else.

The road from Gorgona (six miles nearer Chagres than Cruces) to Panama runs at the base of these spurs, crossing the ridge at a comparatively low point; but it is impassable in the wet season on account of the quantity and tenacity of the mud; in the dry season it is infinitely preferable to that from Cruces.

The dry season usually commences about the middle of December, and continues until the middle of March.

No impediment exists in the construction of a railroad across the isthmus, except the unhealthiness of the climate. No grade of forty feet to the mile need be made, as the valleys will allow any distance to be gained to ameliorate the declivity.

Puerto Bello is an excellent harbor on the Atlantic side and in old times all the trade (I have ascertained this from particular inquiry) passed from thence to this city by a paved road, now covered with the luxuriant vegetation of the climate. It was abandoned because the river of Chagres afforded for two-thirds of the way an easier mode of transportation for the little traffic across the isthmus.

To a trade like ours, what I may call the *entire* want of a harbor at Chagres is infinitely the greatest obstruction.

In making a railroad from Puerto Bello (beautiful port) to this city, the labor must be performed by blacks, who compose two-thirds of the population of the isthmus, and who are faithful *always*, and *industrious when* inspired by good remuneration. The directors and overseers *for the first winter* must be Americans or Englishmen, during which they can instruct natives of the *Spanish blood* sufficiently to be able to superintend during the unhealthy season, until the work is sufficiently advanced to be completed by the engineer, with the precise and scientific niceties of construction, in the second healthy season, at the end of which the work can be completed, if under contract, all at the same time.

I was a civil engineer on the line of a contemplated railroad from the Susquehanna river to Lake Erie, and *each day* after we reached the Allegany mountains we met with more natural obstructions (omitting the unhealthiness of the climate) than exists in crossing the isthmus of Darien to Panama from Puerto Bello; and yet the route was reported practicable without a stationary engine."

It should be remarked that the survey of Mr. Lloyd, above referred to, was from Panama to the river Chagres, by the old Puerto Bello road.

2. Another route to which public attention has been much directed is by the rivers San Juan, with the Atlantic and Pacific oceans and Lake Nicaragua.

Humboldt, in his personal narrative, says: "The isthmus of Nicaragua and that of Cupica have always appeared to me the most favorable for the formation of canals of large dimensions."

Mr. Stephens, in his incidents of travel in Central America and Yucatan, has furnished some most valuable information in relation to this route.

In relation to the harbor of San Juan, he says: "It is not large, but beautifully protected, being almost in the form of the letter U. The arms are high and parallel, running nearly north and south, and terminating in high perpendicular bluffs. As I afterwards learned from Mr. Bailey, the water is deep, and under either bluff, according to the wind, vessels of the largest class can ride with perfect safety." It is said, however, that from the month of May to November the north wind renders the entrance to the harbor very difficult.

Mr. Stephens gives the results of a survey made by Mr. Bailey, a half-pay officer in the British navy, in 1839. He was employed by the government of Central America to survey a canal route between the two oceans. The maps, plans, &c., of this survey were examined by Mr. Stephens, who gives some of the results of that survey.

From that it appears that the distance from the Pacific to Lake Nicaragua is 28,365⅓ yards, or 15⅔ miles. The sum of the ascent is 1,047 feet $5\frac{44}{100}$ inches. The sum of the descents is 919 feet $2\frac{4}{10}$ inches. The difference in the height of the lake above the Pacific ocean, at low water, is 128 feet $3_{11}\frac{1}{3}$ inches.

Lake Nicaragua is 95 miles long—in its broadest part, about 30 miles; and, according to Mr. Bailey's soundings, 15 fathoms deep.

From the lake by the river San Juan to the Atlantic the distance is about 70 miles. A description of this river, and the different obstructions to its navigation, is given by Mr. Stephens.

The whole length of the canal from the Lake Nicaragua to the Pacific is 15¾ miles. Ascending to the plain, in the first eight miles only one lock is necessary; in the next mile 64 feet of lockage are required; in the next three miles there are about two of deep cutting and one of tunnel; and then a descent of 200 feet in three miles, by lockage, to the Pacific.

The Lake Nicaragua is navigable for ships of the largest class to the river San Juan. "This river has a fall of 1¼ foot per mile to the Atlantic. If the bed of the river cannot be cleared out, a communication can be made either by bed and dam or by a canal along the banks of the river. The latter would be more expensive; but, on account of the heavy floods of the rainy season, it is preferable."

He does not consider the physical character of the country as presenting any insurmountable obstacle; and, although the expense would be great, it would be only such as would be required wherever a canal of such large dimensions should be constructed.

He presents a proximate estimate of expense, furnished by an engineer who examined the plans, with the accompanying description of the route, which is, for the entire work, from $20,000,000 to $25,000,000.

According to the examinations of the Spanish engineer, Galisteo, in 1781, the height of the Lake Nicaragua above the Pacific is stated to be 134 feet, instead of 128 feet $3\frac{5}{12}$ inches.

The committee do not deem it important to refer at length to the series of tables given in Thompson's Guatemala of levels of a portion of this route, as the whole subject is embraced in Mr. Mercer's report, which is printed herewith; nor, for the same reason, to the negotiations of Mr. Palmer, of New York, which resulted in his procuring a charter in 1826; nor to the grant made to a Dutch company, formed under the patronage of the King of Holland.

Other modes of uniting Lake Nicaragua with the Pacific have been suggested, which will be found discussed at length in the appendix. Prince Louis Napoleon, in his work on this subject, published in 1846, gives the following distances:

Length of river San Juan	104	miles.
" Lake Nicaragua	90	"
" River Tilpitopa	20	"
" Lake Leon	35	"
" Isthmus between Lake Leon and Pacific ocean	28	"
	278	"

3. The next important point is the isthmus of Tehuantepec, between the sources of the Rio Chimalapa, which falls into the Pacific, and a branch of the Huasacualco, which falls into the Atlantic. This isthmus lies between the sixteenth and eighteenth degrees of north latitude. It has been often stated that the Rio

del Passo, a branch of the Huasacualco, and a branch of the Rio Chimalapa, are sometimes so swollen by rain that canoes of the Indians have thus been able to pass from ocean to ocean. But however this may be, it has been the route for a considerable commerce between the Atlantic and Pacific; and more than three centuries ago it attracted the attention of the early Spanish discoverers, as has been before stated.

In relation to the character of the work to be constructed here, there has been some diversity of opinion. Mr. Wheaton remarks: "The first exploration of this route for a canal communication between the Gulf of Mexico and the South sea was occasioned by the accidental discovery, in 1771, of some pieces of bronze cannon in the castle of San Juan de Ulloa, which it was ascertained, by their marks, had been cast at Manilla. As it was nearly certain that these pieces of artillery could not have been transported to the coast of the Gulf of Mexico by the way of Acapulco, on account of the difficulties of the overland communication over the great cordilleras of New Spain, nor by the way of Cape Horn or the Cape of Good Hope—the trade between Vera Cruz and the Philippine islands not being carried on by either of those routes—the conclusion was that they must have found their way by the isthmus of Tehuantepec. This conjecture was verified by the examination of ancient records, and the tradition existing among the inhabitants of the isthmus, that these cannon had been transported from the Pacific by the Rio Chimalapa and the Rio Huasacualco. This fact, thus ascertained, induced the viceroy of Mexico, Don Antonio Bunaneli, to give orders to two engineers, Don Antonio Cramer and Don Miguel del Corral, to examine the isthmus, with a view of ascertaining whether any natural communication already existed by means of rivers whose branches might interlock with each other, and at the same time to determine the practicability of cutting an artificial canal between the Chimalapa and the Huasacualco. Baron Humboldt prepared his map of the isthmus of Tehuantepec from the report of these engineers, who found that there was no river which discharged its waters at the same time into the Atlantic and the Pacific."

In the year 1814, the Spanish cortes passed a decree for the construction of a canal across this isthmus; but nothing was done in pursuance of it, owing to the subsequent independence of the Spanish American colonies. In 1824, General Orbegoso, under the direction of a board of commissioners appointed by the Mexican government, made a survey of this line. This survey is copied at length in the appendix to this report. One of the results to which he arrived was that a ship canal was entirely impracticable, although the commerce across the isthmus at this point would justify the expense of constructing good roads; which suggestion was so far adopted by the Mexican Congress as to induce them to order the construction of such a road, which has not, however, been carried into effect.

It should be remarked that this survey of Gen. Orbegoso is a very imperfect one. He measured the height of land above the

sea by the barometer, which in the equatorial regions gives results nearly approaching to accuracy. These calculations, however, are not much to be relied upon. This is acknowledged by Gen. Orbegoso himself.

The isthmus, as stated by Gen. Orbegoso, measures, from the shore of the gulf of Tehuantepec to the bar in the river Huasacoalco, 220 killometres or 136 miles. The lagoons which communicate with the sea reduce the distance at least 21 killometres.

It is also conceded that the height of the mountains presents no insurmountable obstacle to the communication between the two oceans, provided a sufficient quantity of water could be found on the summit. The report of Gen. Orbegoso furnishes no hope that regular and reliable navigation can be had in the Chimalapa, or by any other stream descending to the Pacific. The Chimalapa is not navigable, as stated by him, even for pirogues, except during the rainy season.

This examination showed a magnificent vegetation and a rich soil, and in common with all persons visiting the country, he bears testimony to its comparative healthiness at a little distance from the sea. Before the expedition of Cortez to this country, it was populous, and so continued under the Spaniards. It was the buccaneers who destroyed the works erected by the Spaniards on the river Huasacoalco, and, dispersing the population, converted into a desert an admirable country, and flourishing under the sceptre of Montezuma.

A more recent and scientific survey has been made by Senor Moro, who was employed by Don Jose Garay, to whom the Mexican government in 1839 committed the enterprise. The most important portions of this survey are appended to this report.

In relation to the harbors at the termini of that route, there is some diversity of statement, so far at least as relates to that on the Atlantic side. The two engineers, Don Augustin Cramer and Don Miguel del Corral, appointed in 1771 to make examinations of this line, state the difficulty of the opening on the Pacific, and the want of a good harbor there. Gen. Orbegoso concurs in this statement as to the port on the Pacific. Tehuantepec scarcely deserves the name of a road. Since the end of the sixteenth century it has been little frequented. The sea has gradually retired from the shore, and the anchorage become worse from year to year. On the other hand, it is said that the depth of the lagoons near Tehuantepec is generally from 5 to 6 metres, or from about 17 to 20 feet in depth; but the Bocca barra, by which those lakes are emptied into the ocean, is obstructed by a sand bank, which might, however, easily be removed, and a good port thus constructed.

In a letter from Commodore Shubrick, commanding the Pacific squadron, to the Secretary of the Navy, dated Oct. 7, 1847, a copy of which has been furnished by the Department to the committee, he says: "There is, I understand, anchorage in the Bay of Tehuantepec; but all accounts agree with the letter of Mr. Forbes in describing it as exceedingly boisterous. Captain Basil Hall says the

hardest gales he ever experienced were in that bay, and the Spanish charts call it Ventosa."

In relation to the depth of water at the mouth of the Huasacoalco, it has been at different times, from examinations, said to be, by Dampier, fourteen feet; by Cramer, eighteen; by Robinson, twenty-two feet; by Orbegoso, fourteen feet; by Moro, twenty-one feet.

A recent survey was, however, made under the direction of Commodore Perry of the U. S. Navy, of the depth of water on this bar and in the river, and somewhat different results are shown from those shown by the survey of Moro.

This survey was made in January, 1848, and the results of the soundings, which were taken under the immediate direction of Lieut. Leigh, are given on a chart, a copy of which is appended to this report. By that it will be seen that the depth of water on the bar in the best channel is 12½ feet. It is that stated the extreme rise and fall of the tide was 3 feet, and in another note on the chart it stated—"The tides are very irregular, except at the time of full and changes of the moon. At other times I have known them often to remain for a week or more at half tide, so that except when the moon is near the full or change, 13½ or 14 feet may be expected on the bar, with a good deal of certainty."

After passing the bar the depth of water in the river is most ample for vessels of a large class. Sig. Moro in his report says: "The depth of the Huasacoalco from the junction of the branches which form the island of Tacamichapa to the mouth of the Coachapa is 8 metres, and from this to the bar not less than 10 or 12 metres. It will therefore be seen that so far as the island of Tacamichapa, a distance of 55 killometres, or at least up to the confluence of the Coachapa, the Huasacoalco is navigable in all seasons, and for every class of ships, forming a convenient as well as most secure harbor."

It would seem, however, from the surveys under the direction of Commodore Perry, that there are a number of points on the river below the point last named, where there is not sufficient water for vessels of large class to ascend.

The diversity in the results shown by these different surveys may arise from the great quantity of water discharged during the rainy season, and the increased depth of water at that time; but if the survey of the officers under the direction of Commodore Perry is correct, and the committee are not aware that it is disputed, it is quite apparent that at some seasons of the year there is not sufficient depth of water on the bar for vessels of a large class. The necessity of a harbor for such vessels at the termini of such a work is obvious, and it is not as yet ascertained whether by any artificial means this difficulty can be remedied.

The length of the canal and river navigation, is shown by Signor Moro's survey. Giving to it, as he observes, "a number of locks proportionate to that of the Caladonian canal, there would be required on the side of the Pacific 89 locks; on the side of the Atlantic 72 locks—total number of locks 161. "But the number of locks depend upon the accidental formation of the

ground, and, these permitting, there might be given to each lock a fall of three metres; in which case, their number would be reduced on the Pacific side to 67; on that of the Atlantic to 53—in all 120. However, to come nearer to the existing data, and because it might be necessary to put one or more locks where the confluence of the Molotugo, we will suppose that the total number of necessary locks is 150."

The estimate of the cost of the entire work is 85,000,000 francs, or between $16,000,000 and $17,000,000.

Without desiring to undervalue the useful labors of the engineer embarked in this survey, or the valuable information in his report, it seems to the committee that, before the construction of so important and expensive a work as a ship canal, far more extensive surveys should be made of this region.

The committee have been promised some valuable information in relation to the Panama route, and other routes across the isthmus, by the distinguished traveller, John L. Stephens, esq., which they will append to this report if furnished.

Thus much in relation to the routes across the isthmus.

Various routes have been suggested for the construction of a railroad across the continent from Lake Michigan, the Mississippi river and its branches, and the Gulf of Mexico, to the Pacific. To some of them the committee will refer.

The first of these plans which the committee will consider, is that of Mr. Asa Whitney, of the city of New York, to which public attention has been called extensively. As the plan has been long before the public, is pressed with great earnestness by Mr. Whitney, and has received the sanction of the legislatures of eighteen States of the Union, and has been favorably reported upon by committees of both Houses of Congress, the committee deem it proper to consider it at length. Aside from the merits of the proposed route, the committee consider the mode proposed for its construction in the highest degree exceptionable.

The bill on this subject last reported is from a select committee of the House of Representatives during the first session of the present Congress, which is now pending; and as this bill is understood to present the plan of the petitioner, the committee propose first to consider some of the objectionable features of that plan.

The length of the road, as claimed by Mr. Whitney, will be 2,030 miles from Lake Michigan to the Pacific ocean. This estimated distance is, as the committee believe, far less than any required for any practicable line of railroad from that lake to the Pacific ocean. The former estimate of Mr. Whitney, and the distance stated in a former favorable report of a committee of the Senate, by an honorable member from Illinois, (Mr. Breese,) was 2,600 miles; which the committee think is itself far short of the necessary length of any such road.

Supposing, however, the distance stated to be correct, the quantity of land set apart by this bill is enormous.

The quantity proposed to be appropriated is a strip of sixty miles in width, which, for the distance of 2,030 miles, is, as stated

by Mr. Whitney himself, 77,952,000 acres. This land is at once, by the provisions of the bill, withdrawn from market, and is thereby "set apart and sold to said Whitney, under the conditions hereafter declared, to enable him from the sale and settlement of said lands to construct a railroad," &c.

The territory thus set apart and sold is double the area of all the New England States—the entire area of those States being 39,549,440 acres. It is of greater extent than the area of all the middle States by about twenty millions of acres; of greater extent than the area of New York, Pennsylvania, Ohio, and Maryland combined; more than three times the size of Ohio, and nearly three times that of Pennsylvania; more than twenty-five times the size of Connecticut, and more than double that of Illinois. Although this land is not conveyed at the time of the passage of the bill to Mr. Whitney, it is all withdrawn from sale, and set apart and sold and held for the purposes of the road.

In the selection of the point on Lake Michigan or the Mississippi, the government exercises no control whatever; but it is left entirely to Mr. Whitney to select any route which he may choose. He is not confined in his selection to land on or contiguous to the line of the railroad; but, in case of the previous disposition of the land, he is authorized to select an equal quantity of the public lands of the United States lying in any State or territory. On some of the lines for a railroad from Lake Michigan to the Mississippi, three-quarters, or perhaps four-fifths, of the land within thirty miles of such a line have already been sold. The result would be that a very large quantity of land would thus be withdrawn from market, and, under the control of Mr. Whitney, to be selected from any portion of the unsold lands of the United States.

If the route selected by him should be from Chicago to some point on the Mississippi river, if the distance be 150 miles, the quantity of land appropriated would be 5,760,000 acres, and four-fifths, if that amount are already sold of the contiguous lands, would be 4,608,000 acres, an amount equal to nearly one-third of all the unsold lands of Illinois.

The land, by the provisions of the bill, is, from time to time, to be conveyed to such person as Mr. Whitney may designate on certain conditions. On the completion of ten miles of the road, he is entitled to a tract of land of thirty miles in width, and so, on the completion of each ten miles, he receives an equal quantity. Thus he would receive from the government absolutely, and without any condition whatever, on the completion of ten miles of railroad, thirty miles in width, or 192,000 acres; the largest portion of which would, in respect to the route from Lake Michigan to the Mississippi, be selected from any part of the public lands of the United States. This quantity of land, at $1 25 per acre, would amount, for the ten miles of railroad, to $240,000. The probable cost of such a road would not exceed $20,000 per mile, amounting for the ten miles to $200,000; and the value of the land thus received, absolutely without reserve or condition, will be $40,000 more than the cost of the road.

In order to secure the prosecution of the work, it is, indeed, provided that he shall build *ten miles in two years*; in fifteen years, to the South Pass of the Rocky mountains; and finish the whole in twenty-five years. If he builds the ten miles in two years, for which he receives land enough to pay for it, he may proceed to build the road through the populous and fertile portions of the route, and receive, from time to time, his 192,000 acres for every ten miles of railroad, to which there is an absolute and vested title in the person to whom the conveyance is made. It is thus perfectly manifest that he and his associates would proceed in the enterprise just so far as he would find it profitable to go, and no further. It would, of course, soon be built to the Mississippi river, and probably a short distance beyond it. A railroad is already in the course of construction by private enterprise from Chicago to the Mississippi river; and it is quite manifest that, with this most liberal grant, the road would soon be built to that extent.

But, although the road is thus built by the land granted by the United States, and an ample amount is furnished to do so for a distance of a hundred or two miles, when so built, it is the property of Mr. Whitney, upon which he is entitled to charge tolls, and of which he is to receive the profits; and it is expressly provided that the United States mail shall *only* be charged the rates of merchandise.

There is really, on a careful examination of the bill and all its provisions, no security whatever afforded that this stupendous project would be carried out. No such security does or can exist in the pecuniary means of any person in this country; and the petitioner is not understood to propose any other security than is afforded by the provisions of the bill itself. The committee would have supposed that the proposition by any individual to the government of the United States, of the character above stated, would have been regarded as preposterous, were it not that it has received countenance and support from quarters of such high respectability.

What renders the proposition most extraordinary is, that no actual survey or really reliable examination of the line has been made. Beyond the Rocky mountains, the country has been but very partially explored. The government will not make an appropriation of $5,000 for a harbor without a previous careful survey by one of its officers. Not a railroad company in the country embarks in the construction of a road ten miles in length without a previous careful and scientific instrumental examination; and yet, here are millions upon millions of public treasure, or what is one great source of public revenue, proposed to be heedlessly and recklessly embarked in this enterprise. It is really a matter of doubt, within a thousand miles, what would be the length of such a road. Mr. Whitney says that it would only be a little over two thousand miles. Colonel Frémont says that it would probably be nearer four thousand miles.

The committee are desirous that this as well as other lines should be carefully examined by competent officers; but they deem it proper to present what appear to them very serious difficulties in the

prosecution of this work in any form or from any quarter, at the present time, at least.

The physical difficulties are of the most serious character. Sixteen hundred and sixty-five miles, as stated by Mr. Fremont, are 3,000 feet above the level of the ocean—being 157 feet above the highest point of the Allegany mountains where crossed by the Cumberland road; 1,409 miles are 4,000 feet above the level of the sea; 624 miles are 6,000 feet, more than a mile; 198 are 7,000 feet, or a mile and a half; and in two places over 8,000 feet above the level of the ocean. In relation to how far snows prevail in these high mountain regions there is a great diversity of statement; but it must be quite apparent that the difficulties in the construction of a railroad in such high mountain regions in that latitude must be of the most serious character.

There is also another impediment, the importance of which is not sufficiently considered in an enterprise of this kind—the want of wood for a number of hundred miles on the route. All concur in stating that for a number of hundred miles the soil is barren, and no wood whatever is to be found, except to a small extent on the margins of some of the streams. Mr. Whitney himself states such to be the fact, and he urges the large grant of sixty miles in width of land in order that the valuable lands which he may receive may enable him not only to construct the road through them, but through the barren waste for hundreds of miles which lies beyond. Major Fitzpatrick, who was the companion and guide of Colonel Fremont, states that for a distance of eight hundred miles there was not hard wood enough for him to make an axe helve.

The absolute necessity of wood and timber for the construction of the road itself, for buildings, &c., are too apparent to require enumeration.

But a still more important matter is the necessity of an abundant supply of it for fuel, unless, indeed, coal should be found contiguous to the line of the road. No evidence whatever exists that coal is to be found either in or near the largest portion of the proposed route. It is a well known fact that in Michigan, Wisconsin, and in Illinois, north of the mouth of Fox river, no coal whatever has been discovered, nor is it believed to exist. It would be very strange, indeed, if in a line of a number of thousand miles there should not be some points where coal might be found; but there is no proof whatever, nor anything to render it probable, that it exists to any considerable extent through this line. The necessity of transporting the fuel for the locomotives for a distance of four or five hundred miles would of itself render very nearly impossible the sustaining regular trains of cars on such a road. Suppose a railroad extending from Washington to St. Louis should depend upon its entire supply of fuel from one or other of the termini of the road, how serious and almost insurmountable would be the impediment to its successful operation.

It also should be borne in mind that this work will be constructed under the most serious disadvantages. It is mostly through

a new country, where everything would have to be done with far greater difficulty and expense, than where every kind of manufacturing and mechanical labor can be readily secured, and where the competition of years will have reduced the price of numerous articles required in such an enterprise.

But the country is not only new, but, as has been remarked, for hundreds of miles it is a perfect waste; a portion of it is among the peaks and valleys of lofty mountains, and almost in the region of perpetual snow. The expense of constructing a railroad in such a region can scarcely be estimated. The committee will not venture to estimate the expense of such an herculean task, because there exist no data on which to base a calculation; but they are persuaded that the estimate of Mr. Whitney is far, very far, short of the truth.

It seems also to your committee that, before entering upon such a stupendous enterprise, there should be some evidence presented which should render it probable that when the road is finished, if it yielded no profit, there would be sufficient receipts from its business to pay its expenses and keep it in repair. Nothing has appeared to satisfy the committee that such would be the fact.

The support to be received from the borders of the road would necessarily be very small. The select committee, in reporting the bill which the committee have been considering, say: "The representations of the lands in the memorial annexed, correspond with the examinations made by, and the opinions of, the committee. "Of the 2,030 miles, 800 miles is good land, though 500 without timber; then there are several hundred miles of barren desert; then volcanic formations, and but small extent of good land, to the ocean."

From this statement it is apparent that, for a large portion of the distance, there would be but few people on or near the line of the road, and business from its borders, which would seek this road for its outlet, would be exceedingly small.

The results of the business on all lines of public travel and transportation in this country and Europe, show that, on any long line, the local support is the main support; and without a large amount of local business, no railroad in this country would pay its expenses. Some facts on this point may be important, not only in reference to this, but similar enterprises.

On the Erie canal, from Buffalo to Albany, for the first three years after its completion, the through business was only 2½ per cent. of the whole business of the canal; that is, the *local* or *way* business was about thirty-nine-fortieths.

On the Hudson river, which is one of the greatest thoroughfares in the country, the number of way passengers, that is, of persons going by steamboat a part of the way between Albany and New York, is far greater than those going through the entire distance between those two cities. Indeed it might be safe to say that the passage money received from the way passengers is greater than from the through passengers on that river.

The railroad from Boston to Albany, of about two hundred miles in length, is also a great thoroughfare. The Western Railroad Corporation, whose railroad extends from Worcester to Albany, about 150 out of this 200 miles, fully confirms this statement. The late superintendent of that road, Mr. Barnes, gives the following as the result of the passenger receipts for the years during which the accounts were so kept as to show the comparative receipts from through and way passengers:

	Through passengers.	Way passengers.
1843	$78,002 76	$197,136 88
1844	105,628 00	253,066 00
1845	86,350 40	280,402 62
	269,980 16	730,605 50

If data were furnished for the whole distance between Boston and Albany, the proportion of way travel on the through route would of course have been greater; but for this distance the returns from the way travel during these three years, was nearly three-fold that of the through travel; and the revenue from the way travel in one year, 1845, considerably exceeded the receipts from the through travel for the years 1843, 1844, and 1845. The through business on this road would have fallen far short of paying the annual expenses of the road.

The committee have not the precise data in relation to the number of railroad passengers, on the great thoroughfare between Buffalo and Albany, which go the entire distance between Buffalo and Albany, as compared with those that travel but a part of that distance; but they feel perfectly safe in saying that the aggregate of receipts on all the roads for Buffalo and Albany passengers would not equal one-fifth the aggregate of receipts from all of the passengers. Indeed, the through business between Buffalo and Albany would not pay the annual expenses of the various roads.

In the annual report of the Baltimore and Ohio railroad, for the year 1847, is the following statement, in relation to the Washington branch. "The number of passengers carried on this road has been, during the past year 151,683, for various distances, equivalent to the conveyance of 3,834,701 a distance of one mile. Of these, the through southern passengers numbered 17,038 on the whole road=528,178 a distance of one mile—and constituting about one-seventh of the whole number; showing that it is mainly the *local travel* which sustains the road."

D. A. Neal, esq., the president of the Easton railroad, in a letter to the chairman of the committee, under date of the 25th December, 1848, states the following as the receipts by the various railroad companies for passengers between Boston and Portland:

Through passengers	$101,020 67
Local, or way, travel	304,344 43
	405,365 10

These facts, it is believed, most abundantly prove the proposition advanced in relation to the necessity of border support for any railroad. It should, however, be borne in mind that the roads referred to are for comparatively short distances, and not for thousands of miles. They show, the committee believe, that in no region on the face of the globe can any railroad, for such distances, be sustained from the business proceeding from its termini and passing the entire distance. All such calculations, the committee are persuaded, will prove most deceptive, and are absolutely unsustained by experience in this or any other country.

The committee, however, propose to present some few facts and considerations to show that the calculations of Mr. Whitney are most extravagant; indeed, almost preposterous.

The most remarkable proposition of Mr. Whitney is, that this route will be a medium between Europe and China and the East Indies. Goods, according to his calculation, are to be transported from Canton, or some other Chinese port, to the terminus of this railroad on the Pacific. Thence they are to come by railroad some two or three thousand miles to some point on Lake Michigan, and thence by railroad, or some other conveyance, to New York or some other Atlantic port, and again to be transhipped and conveyed by steamboat or sailing vessel to Europe. In relation to this proposition, it should be first remarked that the distance will be nearly or quite as great by this route as from England to Canton by the Cape of Good Hope, and the necessary expense would be many fold greater, with really no compensating advantage, for the slight saving of time claimed is of trifling moment.

So far, indeed, do the committee think these calculations of Mr. Whitney to be relied upon that they are persuaded that the expectation, that the business intercourse between China and the Atlantic cities of this country would be over this railroad of Mr. Whitney, is most fallacious. The committee are satisfied that the cost and inconvenience would both be so much greater by this railroad line, if ever finished and in full operation, than the present mode of conveyance, that not a chest of tea would, in the ordinary course of business, ever be sent from Canton via this railroad to New York, nor any of the ordinary articles of trade between the two countries.

The present cost of transporting tea by ships from Canton to New York, is from $15 to $20 per ton measurement. This falls short of a ton, by weight, very considerably; but suppose that the transportation of a ton, by weight, were double this sum, say from thirty to forty dollars per ton—this is far short of the necessary charges on the proposed line of Mr. Whitney.

The average annual expense of transportation on the best managed railroads in this country to the company itself, without a cent of profit, is about two cents per ton per mile. On twelve principal New England railroads, the average expense, or the cost to the company of the lowest class of charges, is about two cents per ton per mile. On the Baltimore and Ohio Railroad, as appears by the report of 1847, the *charge* per ton per mile is 3.96 cents; the actual cost to the company is 1.849 cent per ton.

On the Liverpool and Manchester railroad, the cost is 1.510 penny per ton per mile, or more than three cents. The committee are of opinion, that with the greatly increased inconveniences and expenses attending such a line as the one proposed, the actual cost to those owning the road would be very much greater than the sum named.

The committee are aware that these statements are questioned; and the Reading railroad, a road of about one hundred miles in length, extending from the coal mines at Pottsville to Philadelphia, has shown different results. What the actual cost of transporting per mile a ton of coal on that road is, is yet a matter of question. Certain it is, that the business is of that character that it furnishes no rule to any other railroad engaged in the ordinary and necessarily irregular business of railroads.

Almost the entire business of that railroad is the transportation of coal from the mines to tide water. The business is enormous; the supply is constant; the greatest labor-saving facilities are furnished for loading and unloading the coal, and the charge or cost of transportation of this article is different from that of other articles of merchandise on this very road. But a most marked difference between this road and that of Mr. Whitney is, that the Reading railroad is, from the coal region to Philadelphia, either level or descending for the entire distance, and a single engine is thus enabled to draw an enormous burden.

In order to show the advantage thus afforded to this road over any road across the Rocky mountains, it may be proper to show its practical effect. An engine that can draw 138 tons, at a velocity of 20 miles per hour, on a level, can draw at the same speed up the following grades:

Level				138	tons.
Grade of	20	feet	per mile	61	"
"	40	"	"	34	"
"	60	"	"	24	"
"	80	"	"	17	"

It is, therefore, quite apparent the example of the Reading railroad is no more to be relied upon as an example of the cost of transportation on railroads generally, or this road of Mr. Whitney's especially, than its enormous cost per mile is evidence of the cost of such a work from Lake Michigan to the Pacific ocean.

If, therefore, the computation be of two cents per ton per mile on this road, and the length of the road be, as it probably will be, at least 3,000 miles, the cost of transporting a ton of tea or other merchandise across the railroad will be $60; and even if the distance is supposed to be, as claimed by Mr. Whitney, only 2,000 miles, the cost would be $40 per ton. Thus the transportation on this railroad would actually cost those operating the road, for a ton of merchandise, as much as the highest price now charged from Canton to New York. What the price would be from Canton to the Columbia river, and how much from Lake Michigan to the city of

New York, or other Atlantic cities, the committee have not the means of estimating. The charge would surely not be less than ten dollars per ton from Lake Michigan to New York, and probably an equal charge from Canton to the mouth of Columbia river. The hazards of loss, and the inconveniences of this mode of conveyance, the committee are assured must be far greater than those attending the continuous voyage between China and our Atlantic seaports.

It thus appears to the committee that the China trade with the Atlantic cities of the United States would not be diverted from its present track by the construction of Mr. Whitney's railroad. It is still more apparent that it can never be a thoroughfare for the European trade with China. Indeed, it strikes the committee with surprise that any such opinion should have been seriously entertained. The distance from England to Canton by the Cape of Good Hope, is very little if any more than by the proposed route of Mr. Whitney. If by the course of the voyage the distance should be a little increased, or the time greater, it is of very trifling importance compared with the greatly increased expense and the risks of delay and loss attending the repeated transhipments on the route marked out by Mr. Whitney.

Nor is the amount of this business of the United States with China so large as many seem to suppose. Official reports show that the exports and imports to and from China and the United States annually amount to less than 50,000 tons, which is not equal to two weeks business at some seasons of the year on the Reading railroad.

If the road were constructed, the annual expense attending the repairs and operations of the road would be enormous. Some of these can simply be mentioned: The repairs and renewal of engines and cars; the supply of fuel; the establishing and sustaining of workshops at proper intervals; the supply of water at intervals not exceeding twenty miles, with persons at the stations, and buildings, &c., for their accommodation; the removal of snow from the track. The expense of the repairs of railroads varies on different roads. The average annual expense of the Boston and Providence railroad for nine years was $356 48 per mile. Supposing this railroad to be 3,000, and the expense no greater in this wild and savage region than in a civilized country, the annual expense of repairs would be over a million of dollars. How many millions of dollars it would require to meet the annual expenses of such a work the committee cannot of course say, but they are perfectly satisfied that they would by very much exceed any receipts which would arise from any business on the road at this time or at any period not very remote.

The committee have availed themselves of the best lights in their possession in relation to the character of the route proposed by Mr. Whitney, and believe that they have not given a too unfavorable view of the subject. It must, however, be confessed that the information is exceedingly defective, and the committee are especially desirous that this route should be carefully examined by

competent officers, who shall make a thorough examination and present a full report, with estimates of expense, &c.

The committee are unable to consider at length the various other routes suggested for a communication across the continent, but refer to some valuable information furnished to them, and appended to this report.

The committee recommend the passage of the joint resolution referred to them, with an amendment authorising, in addition, surveys from some point on the Gulf of Mexico to the Pacific ocean.

MEMOIR

ON

THE ROUTES OF COMMUNICATION

BETWEEN THE

ATLANTIC AND PACIFIC OCEANS.

BY J. H. ALEXANDER, Esq.

Etc., etc., etc

MEMOIR.

The acquisition by the United States of Upper California and New Mexico has effected a remarkable change in political geography; and, in one aspect, is the more important, since it affords now, for the first time, an opportunity of solving a great problem of more than three centuries. Four hundred years ago, the dream of the world was that the nearest road to India lay in steering continually west from Europe; and that dream may now come true in finding, across the very obstacle of an intervening continent a means of transit more facile and rapid than ever entered into the sanguine conceptions of Columbus.

Of course, the knowledge of the existence of such an obstacle stimulated, all the more, efforts to avoid or overcome it; but the 25th of September, 1513, when the unfortunate Balboa, in his search for gold, first looked upon the Gulf of St. Michael and the waters of the Pacific, may be dated as the birth-day of the idea of a navigable communication between the two oceans. The passage, seven years later, of Magellan through the straits which still perpetuate his name, realized the letter but not the spirit of this idea; for it was, in fact, but a circumnavigation of the American continent; and although shorter in absolute distance, by about 540 equatorial miles, than the route to double Cape Horn, which was subsequently tried, yet on divers practical accounts, (principally, I am informed, the absence of lights,) it is found less convenient than this last; so that now, unless from some special motive, vessels rarely, if ever, make the passage through the straits. Neither of these routes, however, at the time of their discovery or since, satisfied the conditions of European commerce; which, since the determination of the Cape of Good Hope by Bartholomew Diaz, or, at least, since the Indian voyages by it of Vasco de Gama, was in possession of a shorter and in many respects more convenient access to Hindostan and China. And, even if the difference between the eastern and western voyages had been actually less than it is, there were circumstances which tended to keep up, and even exaggerate, a general predilection for the former. Thus, for instance, even in the then imperfect state of geographical knowledge and means for acquiring it, it was supposed that from Ferro, in the Canaries, (the principal meridian of the Portuguese navigators,) to the island of Ceylon, which was looked upon as the entrepôt of the treasure in spices and gold that belonged to a not much remoter clime, and where Portugal early asserted her sovereign claim; it was supposed, I say, that between these points there was a difference in longitude of not more than 100° by the eastern route, leaving 260° to be overcome by a western voyage; while, as soon as the position of

the African and American capes was determined, there was recognized a difference of more than 30° southing by the latter, in doubling which arose a difference of more than 60° of latitude against the western route. I believe, therefore, that in the average estimate of navigation of the sixteenth century, the voyage from Europe to Japan, for instance, by the western route, was rated at half as long again as by the eastern.

Under this estimate, which was not reduced for a long time nor until greater experimental data as to winds, and currents, and season, had furnished the elements for correcting the proportion, it was only for enthusiasts devoured by a desire for distinction or a thirst for gold, or for certain statesmen, whose calculations outran the careless or contented views of their cotemporaries, to speculate or search higher up than Patagonia for a way of piercing the American continent. And as our knowledge was increased upon the extent and the elevation of the intervening land, the idea of a ship channel (through which ocean vessels, without unshipping freight, might pass) grew by degrees fainter and more faint. It is to causes like these—the gradual abandonment of the hope to find a navigable channel, natural or artificial, which would cut off the excessive distance by Cape Horn, and the change of the focus of commerce from the Iberian peninsula to the British isles, whereby the circumnavigation of Terra del Fuego became still more disproportionately tedious—that we must ascribe the origin of an imagined *northwest passage*, which, from the commencement of the 17th century to now, the middle of the 19th, has so brilliantly, though unsuccessfully, attracted British patronage and enterprise. This was virtually a giving up of the southwestern route, and a presage or an acknowledgment of the inadequacy of passages existing, or likely to exist, between the boreal and austral terminations of the continent.

It is not surprising, therefore, under all these circumstances and this permanent state of opinion, that the question, although brought forward repeatedly, as new facts or new speculations stimulated some active mind to its investigation, should have failed so long to command an interest sufficient for its solution. It is only within the last twenty years, that the commercial facilities of railroads and the necessary and economical agency of steam upon them have been so recognized as to allow a reasonably feasible aspect to projects of artificial communication; and only within the last twelve months, that any party has come to combine the requisite control of means in money and territorial sovereignty with demands of its own commerce and necessities of its own government and defence, enough to induce the serious consideration and execution of such an enterprise. It is the United States alone that can expect solid and permanent advantage in undertaking and carrying through a scheme so replete with unforeseen results as that of an artificial communication between the two oceans. This is not said with any view of depreciating or discouraging private or individual enthusiasm or enterprise: it is the calm deduction from the experience and history of the Past.

Whether this deduction, as to the peculiar character and requisites of the party to construct such a work, be unanimously admitted or not, it is a fact that resort to just such a party that has been indicated, has always been suggested in every scheme for the purpose; the very party named, has been more or less relied upon in every recent scheme; and at this very moment, by the friends of the most recent, the Congress of the United States is invoked for a grant of assistance. These facts serve to confirm *a posteriori* the inferences that were warranted *a priori* without them; and the whole subject comes up fairly, then, as a question of policy to be followed, and a piece of work to be done in form or in substance, by the national means of the United States.

It is obvious that, whether in this aspect or in any other, a just conclusion can only be drawn, even as to the merits of any particular scheme, after an investigation of the facts and probabilities belonging to the others that have been or may be recommended. It is necessary, then, to give in advance a statement of the general features, at least, of the various routes that have been at different periods proposed. This will be done here; taking them in the regular order of geographical position from south to north. The straits of Magellan have been already referred to, as being in fact in the line of circumnavigation; they do not enter, therefore, into the category of routes to be particularized.

1. About a century ago, it was supposed that a communication could be found between Port St. Julian, on the Atlantic, in latitude 49° 30' south, nearly, and some point on the Pacific; as, for instance, what has since been figured on recent English maps as Eyre Sound. The absolute width of the continent here, following Viedma's track from St. Julian to Lake Cupar, is not less than 270 equatorial miles; while, if we assume that the navigation could only exist feasibly on the Santa Cruz for a great part of the way, the distance would be increased to 334 miles, without regard to sinuosities. The distance between the same extremities by way of Cape Horn, may be stated at 1,200 equatorial miles. As to the levels of the summit passage, or the physical obstacles to its construction, there is no information. It may easily be assumed that the little gain in distance (say 1,000 miles) would be balanced by a very moderate outlay for its attainment.

2. A greater inducement was apparent in a scheme for traversing the continent from the Gulf of St. George, a deep indentation on the eastern side, to some similar one on the western, over against the archipelago of Chayamapu. Missionaries, in their pious peregrinations, had observed such an opening in the Estero or Inlet of Aysen, about latitude 45 degrees; and in the latter part of the last century, the Spanish government ordered an expedition for farther examination. The results of this, as given by Humboldt who saw the manuscript reports, and the position of the gulf of St. George by Malaspina, shows that the proposed traverse would be not less than 285 equatorial miles of fast land against 2,010 miles by Cape Horn, to the same termini. Of the difficulties or expense to be encountered in removing this fast land, there is no account; but

it is manifest in this, as in the last case, that the inducement is not enough for any very vigorous or costly exertion.

3. I am not aware of its having ever been proposed to use the Rio Negro (the actual boundary between Patagonia and La Plata, and whose embouchure is about 41° south latitude, near the Gulf of St. Antonio) as a means, in connection with artificial continuations, of reaching either Valdivia on the Pacific, or of coming out into the Gulf of Ancud between Chiloe and the main; but the geographical circumstances appear eminently admitting of feasibility. Between the point on the Catapuliche, (the northern arm of the Rio Negro,) which Villarina reached in boats, in 1782, and the Lake Huanahue, the head of the Valdivia, there is less than fifty miles of fast land; while, between the head of the south branch of the Rio Negro, the Lake Nahuelhuape where the Spaniards had long ago a missionary settlement, and the lake of Todos Santos that communicates with the Pacific, there is hardly ten miles of intervening ground.

This last route would recommend itself as the least expensive; for the Encarnacion is a wide and, for some distance at least, a navigable river. The other has the advantage of connecting with the harbor of Valdivia, which has been long recognized as the finest and safest on the Pacific.

As the continent does not begin to widen materially for some distance above the embouchure of the Rio Negro, it is not probable that the Cordilleras, at either point, assert an impassable domain; but in regard to this, there is no detailed information. Between the mouth of the Rio Negro and the bay of Ancud, the longer of the two routes, the absolute distance, regard being paid to the physical configuration of the line but not to its sinuosities, may be taken at 630 equatorial miles. The communication between the same points by way of Cape Horn, is not less than 2,430 miles; thus affording a difference in space of 1,800 miles, and in average time, if we reckon on a journey forth and back, of about 33 days. But this time is only the topical estimate; it would, of course, vary for ocean vessels, at least on the Atlantic side, according to the port from which their departure might be counted.

4. From these points the continent begins to widen, until along the mean parallel of 7° south latitude, or between Cape Blanco on the Gulf of Guayaquil and Pernambuco, it attains its enormous breadth of 2,800 equatorial miles. It is precisely where this widening is going on upon both sides with its greatest rate, that nature has furnished avenues for traversing it. The rivers Huallaga and Ucayali, each a branch of the mighty Amazons, are both found not far from Lima; and their sources are respectively close (say five to ten miles) by those of rivers that empty themselves on the Pacific side of the Cordilleras. The height which the Cordilleras here attain, forbids any other improvement of the summit level beyond a road; the Vinda pass, for instance, in less than 50 miles from Callao, is elevated more than 15,000 feet above the sea. But the navigation could be extended very far up the branches of the Amazons; though up to the past year, steamers have not gone higher than to

the mouth of the Rio Negro—a distance, counting from Para, of about 900 miles. This is about one-third of the entire distance between Lima and Para by way of the Huanuco; which may be set down at 2,300 equatorial miles.

To compare this with the voyage around Cape Horn, we must take, as the shortest distance of circumnavigation between the two points, not less than 7,600 miles. Taking the rate of the earliest steamer that ever penetrated the Amazons, the former route is equivalent in time to 24 days including stoppages, or say three weeks. The latter could hardly be performed under three months. It cannot be doubted that, whatever might be the applicability and usefulness of this route to Indo European commerce, its importance to that of the western coast of South America is immense. Unfortunately, it needs for its activity and establishment the concurrence of three high contracting powers—the States of Peru, of the Equator, and Brazil.

5. After passing the equator, the great Cordillera which hitherto has been trending westward and north, now suddenly turns N. N. E., to abut against the Caribbean sea; and thus gives room for a new hydrographical system whose waters debouche from the south. In this system, the valleys of the Magdalena, of the Cauca and of the Atrato, might naturally be expected to furnish opportunities for connecting the two oceans. In point of fact, the last named river was used, sixty years ago, to serve this purpose. As far as I am aware, Humboldt was the first to signalize this fact; and I cannot do better in its exposition than employ his own words, rendered in our own language. "In the interior of the province of Choco," says he, (Essai Politique, p. 255, Paris, 1811, 8vo.,) "the little ravine (*quebrada*) of the Raspadura unites the neighboring sources of the Rio de Noanama, called also Rio St. Juan [as it is upon our maps] and the little river of Quito. This last receiving the Rio Andageda and the Rio Zitura form the Rio d'Atrato which pours into the sea of the Antilles, while the river San Juan falls into the Southern ocean. A very active ecclesiastic, curé of the village of Novita, had had a small canal dug by his parishioners in the ravine of the Raspadura. By this canal, navigable in heavy rains, canoes loaded with cocoa *have passed from one sea to the other.* Here, then, is an internal improvement existing since 1788, and unknown to Europe. The little Raspadura canal connects two points on the shores of the two oceans, distant 75 leagues [225 equatorial miles] from one another."

Mr. Humboldt has not stated the length of this canal, which figures on the most modern maps as nearly 15 English miles; in point of fact, according to Mr. Wheelwright, who appears to have seen it not more than ten years since, it is scarcely 3 miles; but the canal is filled up; and the European freights that for many years were conveyed by it to Choco on the Pacific, are now obliged to be sent across, by way of Panama. Neither of the observers have given any definite indication of the level of this former canal above tide; which, however, from the fact of its having been so long navigated, cannot be any material quantity—none at least that a

steam-tug could not overcome with much more facility than canoes. It would be fallacious to compare the distance by it between the Gulf of Darien and the mouth of the San Juan, with the circumnavigation of Cape Horn, as I have hitherto done for the other routes; although the advantages of its employment would be in several instances even greater than the disproportion thus shown. In view, then, of all that has been said, I cannot help considering this route, among all others that present a feasibility of passing sea-going vessels from one ocean to the other, as the most worthy of careful examination and the most likely to be attended with success.

6. These characteristics are perhaps to be shared with another route which, at first attracting great attention, has now for many years appeared to have been forgotten, without (so far as I am aware) any thorough or even particular research having revealed latent or fatal defects. This was the route suggested by Mr. Gogueneche, himself a practical pilot, who had navigated both seas, and whose opinion is entitled to more than ordinary consideration. It reposes, as might be expected, upon the same geographical peculiarities as the last mentioned; and in fact would use the same basin of the Atrato, only entering at a different place. About 130 miles north of the embouchure of the San Juan is found the town of Cupica, situate on a bay and little river of the same name. From Cupica to the landing on the Naipi, a navigable branch of the Atrato, intervene not more than 15 or 20 miles of land perfectly level, and quite suitable for canalling. Indeed, in this respect, it is affirmed by Humboldt that this is the only place on the whole continent where the chain of the Andes is entirely broken through. The whole distance between the bay of Cupica and the Gulf of Darien would be by this route about 125 miles; of which the one-sixth part might possibly have to be artificial. Although there is no detailed information as to levels, it seems to be admitted that the localities would allow a thorough-cut; thus freeing the communication from the expense and inconvenience of any other than guard-locks. The only objection that I have ever found brought against it, is that the Naipi is "extremely shallow in the dry season, and a mountain torrent during the rains." I presume that this refers to the portion above the *embarcardero* or landing; and however correct the figurative language used (since there is no mountain for the torrent to flow from, although it may flow full and rapid *like* one) may be with respect to the upper portion, it is clear that it cannot apply to the lower part, since that is continually navigated. As little can it be doubted, either, that the construction of a canal bringing through the more elevated waters of the Pacific, would in itself, rightly applied, tend to remedy the intermittent disorder of the river navigation. Another argument brought against its possessing of the advantages represented, has been in the fact of the Raspadura canal having continued to be used, in spite of the suggestion of this other route. But I suppose that the contented use of what is *good* (especially among a population notorious for a conservative inertness) does not absolutely pre

clude the possible existence of something *better*; otherwise the continued use of the route by Cape Horn, in the face of three centuries of suggestions as to changing it for one shorter and more convenient, must serve equally as an argument against any and all routes. I must confess, then, that if Congress, inspired by a cosmopolitan enthusiasm, should wish to divert a part of the national means towards the improvement of other territory than our own, a preliminary examination into the physical features and capacities of this and of the preceding route, seems to me, (while it would not detract from the magnificent disinterestedness of the design,) eminently justified, if not required, in the exercise of prudent and reasonable caution. It is possible that such an examination duly comprehensive, might authenticate, to better purpose even, certain hitherto apocryphal stories of adjoining localities; like that of Saldanho, for instance, who affirms that from the Chuquaneque, a river that runs into the Gulf of St. Michael, may be distinctly heard the roar of the Atlantic.

7. I hardly know whether I should not rather class in this apocrypha the possibilities which have been sometimes quoted for a communication between the river Chiapo on the Pacific, and the bay of Mandinga on the Atlantic; but as I mean this account to be a tolerably comprehensive enumeration, I forbear to exclude any. The Mandinga territory inhabited by Indians of a more determined caste than those on the continent, and who have always maintained their independence and isolation, may be justly called, par excellence, the terra incognita of the isthmus. So says Mr. Wheelwright; who in this respect has added confirmation to the accounts given more than a century and a half ago by Wafer. The width of the isthmus is here more restricted than at any other point, being hardly 25 miles from sea to sea. But an unbroken continuity of profile, as far as can be seen from the offing, (for the jealous policy of the Indians has hitherto forbidden access to the interior,) and the absence of any important stream in either side to have carried away much of the fast ground, tend to prove that a work here for a canal, if accomplishable at all, could only be executed at great expense; while the proximity of the table land to the shore on the Atlantic side would impose a similar condition upon a railroad.

8. We come next in geographical order to the route proposed to be established somewhere between Chagres, on the Atlantic, and Panama, on the Pacific side of the isthmus. This is the one referred to just now as the most recent also. The fulness with which it may be supposed the information concerning it has been laid before Congress, in support of the pending application for national help, dispenses me from the necessity of entering into much detail. I shall not, therefore, refer to the earlier history of the attempts already made to this end; and I am not aware that any material information has been added since 1845. It may be remarked, however, that the present proposition appears to abandon the idea hitherto of a ship-canal, and confines itself to the construction of a Railroad between harbors on either ocean. It must be confessed that

this restrictedness, although justified by the circumstances, is also a limitation of the usefulness of the work in its commercial aspect, and diminishes, in so far, its earlier claim to the interest of the world. The width of the isthmus at its narrowest between Chagres and the bay of Chorera is, according to Mr. Lloyd's map, not quite 32 equatorial miles; but it has been always contemplated to lengthen this distance in the use of some of the natural features of the ground. The river Chagres, for instance, the only one of importance on this side, penetrates, by a tortuous course but south-eastwardly towards Panama, a length of forty-five miles, nearly to the village of Cruces; near which tributary sources, (though the main stream is continued much farther up in a northeast direction among the mountains,) almost interlock with those of the Rio Grande and Caimito, which debouche into the Pacific at Panama, and near Chorera, respectively. These latter streams are not available for navigation to any extent; but the Chagres, which is, in fact, used as far as Cruces, (making the upward voyage of 52 English miles in four or five days,) may be advantageously employed with steam power as far as the mouth of the Trinidad, say 14.7 equatorial miles from Chagres, the town. Thence, the nearest railroad line, itself nearly straight, would be 25 miles to Chorera bay; while from the same point to Panama bay would be 30.5 miles. As this last line appears to have been the preferred route, we may take the whole distance for transit by land and water at 45 equatorial miles. The survey of Mr. Garella, for a canal, makes it very nearly 41 miles. The elevation of the summit level to be passed has been very discrepantly stated. The Solomon Company, confirmed in this respect by the later personal inspection, (though without instrumental aid,) of Mr. Wheelwright, make the height about 35.4 feet above high water at Chagres; an elevation, which, although, from its perseverance, it might present a serious obstacle on the score of expense to a thorough-cut canal, would not be much in the way of other méthods of improvement. Mr. Garella, on the other hand, recognising these preceding statements, is convinced, from his own instrumental survey, that they are in error; and states the height of his own recommended line by the Ahogayega pass at (I am obliged to quote from memory of his report, perused some time since, and not immediately accessible,) 140 mètres, or 459.3 English feet. The equated distance of this line, which I shall present hereafter, is very near the mean of the different statements; which, on general principles, I prefer to use, and which here can be the less objected to, since it is manifestly in favor of the projét, either by canal or railroad. In regard to an undertaking of this last kind, the principal difficulties occur in the preliminary navigation of the river, and in the harbors at either extremity. The Chagres bar—a ledge of limestone—gives but 12.5 feet average depth of water; in the river, to the junction of the Trinidad, there is from 2.5 to 3.5 fathoms, with bold and convenient banks; "a little above the junction, the water shoals off to seven and eight feet." The Trinidad is here both wider and deeper than the Chagres; but this does not hold for any distance. As to the harbors, nature has

not been kind. Mr. Lloyd conceived that "the great inconvenience that vessels drawing more than 12 feet water cannot enter the river, even in perfectly calm weather, while the lee current that sets on the southern shore, particularly in the rainy season, renders the entrance extremely difficult and dangerous," may all be remedied by connecting the river, through an artificial canal, with the neighboring bay of Limon. This bay, says Mr. Wheelwright, "is certainly capable of being made an excellent outlet; its worst feature is its being open to the north, and the north winds are the only violent winds which are experienced upon the isthmus. A breakwater is without doubt practicable, and an excellent artificial harbor could be made." The Rio Grande, at its mouth, allows 16 feet of water; but this is continued for a very short distance, and the river is not navigable at all, but for canoes, at three miles up. The roadstead of Panama is entirely exposed; and, except in so far as certain islands, not remote from the main, afford safe anchorage, there is no harbor against northerly winds. This paragraph may be not inappropriately terminated in the words of Humboldt, in reference to this very project which, in his day, was a canal: "Even," says he, "if the canal should be dug, it is probable that the greatest number of these vessels [freighted from Europe for the East Indies] will continue their voyages round Cape Horn. We see that the passage of the Sound is still frequented in spite of the existence of the Eyder canal uniting the ocean and the Baltic. It will be different," he adds, however, "with the productions of Western America or the freights which Europe sends to the shores of the Pacific, to Quito and Peru; these freights would traverse the isthmus at less expense and, above all, in time of war with less danger, than in doubling the southern extremity of the New continent." It seems to me that the distinctions and probabilities here drawn, are well to be remembered.

9. The river Nata, whose mouth is nearly due north from Point Mala the western cape of the Gulf of Panama, is, in respect to harborage, more advantageously situated than the Rio Grande or Caimito. There is no obstruction or embarrassment in its entrance; and vessels, drawing 12 feet water, may penetrate to a landing about 15 English miles from its mouth. From here, a connection may be made with the Trinidad, and thence to Chagres, under circumstances precisely analogous to the Panama line. The plain is the same; and the levels may be presumed nearly identical. The actual distance from sea to sea is, of course, greater, being 55 miles; but taking off 14.7 miles for the navigation of the Chagres as before, and 13 miles for that of the Nata, we have 27.3 miles as the length of a railroad line, which is about the mean between the shortest to Chorera and that to Panama.

10. Westward of the Gulf of Panama, the Cordillera asserts its old domain; the ridge, in some places said to be 5,000 feet in height, is apparently persevering; and a canal, other than with heavy lifts, may be regarded as impracticable. There are nevertheless points here too, where advantages of another kind are presumed to balance the inconvenience of ascents and descents on

a railroad. Such are Boca del Toro, close by the dividing line between Veragua and Costa Rica on the Caribbean sea, and Chiriqui on the Pacific. Between here, the isthmus is about 35 miles across; nearly the whole of which, however, would have to be of artificial improvement; for no important stream on either side occurs, to be used to any extent in navigation. The ordinary and even the latest maps, indeed, show a broken range of land between; but this is either the fancy of the engravers or in reliance upon reports of "a deep gorge that breaks the western ridge"—such as Wheelwright was told of; but which he, with his eyes upon the locality, thought was to be received, if not with doubt, at least with extreme caution. In amends for this, the anchorage at Chiriqui is made safe and convenient by numerous islands which fringe the harbor; which can be entered with 16 feet and even 18 feet, while the bay of Boca del Toro in capacity, depth, and placidity, is magnificent. Indications of bituminous coal show out on both sides of the isthmus; and, in fact, coal itself, affirmed to be suitable in quality and quantity for steamers, has been found both at Boca del Toro, and the island of Muerto on the Pacific. From the geological indications, it is supposed that the deposite is uniform and runs through the isthmus.

11. We come now to another route which, in spite of formidable difficulties, has been considered applicable to the purposes of a ship-canal. This is the connection of the two San Juan rivers, on the Atlantic and Pacific, through the great lake of Nicaragua. The information upon this, we owe chiefly, if not entirely, to the enterprising and agreeable traveller, Mr. Stephens, who took the pains to collate and extract from the minute surveys of Mr. Baily. As in Mr. Stephens' Narrative of Incidents, &c., in Central America all these details are found, and as the work is very accessible, I am spared the necessity here of entering into minute particulars. Counting from the Atlantic side, then, the San Juan de Nicaragua, with a fall of 1 85 feet per mile, might be made navigable for steam-tugs through its whole extent of 79 English miles; but it is supposed that a continuous canal along its banks would be preferable, although more expensive. The port, though small, is considered unexceptionable. The necessary length of navigation on the lake, is not precisely stated; but may be taken at an average of fifty miles. From its western *embarcadero* through the fast land and the tunnel, which would be about 1 mile, there are 15¾ English miles to the mouth of the San Juan del Sur on the Pacific; with a total fall of 128¼ feet from the lake to the sea, overcome with a rise and fall of 272 feet of lockage. The cost of the work (in artificial length, say 86 miles English, and altogether, say 140 English miles,) is estimated at a mean of $22,500,000. Applying these measurements as given, to the question of the levels of the two oceans, they result in showing a difference in favor of the Pacific of 18.5 feet; being 5 feet, very nearly, more than found by Mr. Lloyd at Chagres and Panama. However, the elements in this case are not given with sufficient details to afford a precise result. In regard to the policy of the design, I confess that, even after reading the

emphatic and brilliant pages of Mr. Stephens in its favor, as I have lately done, I cannot consider the advantages of a canal as balancing the requisite efforts and expense. A railroad would be different; and in some regards, even with greater length, might be more advisable than the shorter, more eastern routes. It does not appear, however, that this last idea co-existed with the surveys made of the localities. The main embarrassment of either may, perhaps, be found in the defects of the harbor on the Pacific side, whose roadstead (the bight of Papagayos) commemorates in its name the recurrence and fury of the northeasters which, in January and February, sweep over it. At a later season, in August, September and October, fearful storms and rains harass the harborage, too.

12. I shall pass, with a very brief indication, the route which would connect the bay of Honduras, by means of the Chimaluzon, with that of Fonseca or the Rio Lemba, on the Pacific. Nothing more is known of this than the reported assertion of the Spanish engineers, at the close of the last century, that the ground was practicable for a canal. So far as the general physical geography of the district—wholly unknown, however, in detail—would serve for a conclusion, such a work here might be pronounced impracticable. It is by no means unlikely that a railroad, with reasonable grades, might be conducted across. The money and lives that have been spent in useless political revolutions in that country, have been more than sufficient to purchase an improvement permanent and civilizing like this. The distance across may be taken at 150 equatorial miles; of which one half would be entirely artificial; the remaining hundred miles would consist of an improved navigation on existing water courses.

13. What was said just now as to the defects of the harbor of San Juan del Sur, in connection with the Nicaragua route, applies also in the consideration of another which has long since attracted great attention, and in which interest of late seems to have been revived: I mean that over the isthmus of Tehuantepec. As I believe this scheme has been recently and specially presented to Congress, in contrast with the Panama route, I shall not in it, any more than the other, enter into details which are not absolutely necessary for an intelligible exposition. In regard to the approaches on either side, nature has been unkind; and Ventosa bay on the Pacific is, in its very name, an apt expression for the character of the roadstead; while on the Huasacualco side there is nothing to protect the entrance, of that river from the northers of the Caribbean. The recent survey of Lieutenant Leigh, of the U. S. N., of this entrance, has not been accessible to me; it is said, in a document lately presented to Congress, to result in showing that vessels of more than twelve feet draught cannot be carried in. It is nevertheless to be remembered that this draught is about as much as can be obtained in the Chagres for the Panama line; so that in this respect, in the present state of our information, the two lines are on an equality. If, however, we should assign to Mr. Leigh's determination only the weight of one individual observation among

several of others who have professed to survey the localities, the balance would be shifted against the Chagres; for Mr. Moro, for instance, a French engineer, who explored this isthmus in 1843, found the water on the Huasacualco bar twenty feet; Orbegoso, in 1825, made it fourteen feet; while Cramer, an engineer of well known ability, had sounded, in 1774, with eighteen feet. A more serious difficulty in this respect occurs on the other side; the Bocabarra, through which the lagoons of the Chicapa connect with the Gulf of Tehuantepec, having not more than nine feet. How far this is alterable by artificial means, I do not undertake to determine. The absolute width of the isthmus between sea and sea, may be taken at 115 equatorial miles; but the actual distance to be traversed will be hardly less than 125 miles. This, from the mouth of the Huasacualco to the Tarifa summit, may be taken at 92 miles; and from thence to the Pacific, by the Chicapa and Bocabarra, 33 miles. The summit level between the two may be called 650 feet; and thus there would be on the northern side a six and a half feet lift nearly for every mile English, and three such lifts in the same distance on the Tehuantepec side. The accomplishment of this and more, provided there be plenty of water, of which I believe not much doubt is entertained, is fully within the domain of moderate mechanical skill; and, in fact, is a question of mere toil and expense. But such works are precisely of the kind that an engineer, unless a very unambitious one, would much rather devise than superintend. There is no doubt that a railroad over the whole distance, of the same capacity as a canal for freight, and of much greater rapidity of transport, could be built for a fourth part of the cost and in little more than half the time requisite for a canal. Indeed, upon a careful review of the whole subject, I should despair of finding ground for a *ship-canal*, such as the world might use as it wanted, and at all commensurate with the idea that has so long preoccupied that world, any where else than in the valley of the Atrato. Whether we, the United States, should go to seek it there, is quite another question. If, then, the Tehuantepec route be regarded only as a railroad line, it presents itself in favorable contrast with the most of the others that have been mentioned. So far as all or any of these may be expected to become channels of Indo-European trade and commerce, it may be reasonably doubted whether the African voyage would be abandoned for any mixed method of transport, south of the Gulf of Mexico; in this respect, therefore, they all stand very much alike. So far as American commerce is concerned, and especially that between our own territories on the two sides of the continent, this Tehuantepec route appears preferable, in saving distance and time, to any other more to the east or south.

14. If the physical geography of the country, since we left the isthmus of the Papagayos, is unfavorable for the construction of a ship canal, much more so is it in an ascending direction, where the great North American continent so expands itself that the Gulf of Mexico and the Sea of Cortes and Hudson's Bay are but slight accidents in its contour. The remaining routes that I shall refer to,

therefore, are exclusively for railroads. These are, of course, liable to be classed under the same category of *mixed communications*, to which I have already indicated the serious commercial objections. Nevertheless, here such objections apply only in kind, not in degree. For these railroad lines form, in their length, position, and means of access at either end, such important features in traversing the globe as entitle them to the rank of integral, at least independent, systems; and their claim in this respect is still farther maintained by the functions which they would perform towards our internal commerce, to which all the preceding routes hold a very different relation. Constructions along all or any of these routes would be, it must be remembered, *external* improvements; it is only for those that lie in our own territory that the name of *internal* improvements can be claimed. The first of these routes, and one which I believe is now presented in any detail for the first time, would commence at St. Louis on the Missouri, or, for the moment, at Independence on the same river; and thence pursue a line in general identical with the present Santa Fé trail along the heads of the Osage and and Neoshe, the valley of the Arkansas in part, and the upper waters of the Cimaron and two Canadians, by or through the town of Santa Fé to the Rio Grande del Norte or River of Texas; thence down this river, to where the Sierra Madre is pierced by the sources of the Gila, and down the valley of this last to the head of the Gulf of California and so over to San Diego; on the Pacific, with an extension hereafter, if necessary, along the coast (or rather at the foot of the coast mountains,) to San Francisco. The distances along this route, as measured by an odometer along the marches of exploring parties of the United States, (though there is no doubt but that they could be materially shortened,) are as under:

	Equatorial miles.	English miles.
From San Diego to Santa Fé.....	900	1,043
Santa Fé to Independence.....	600	765
Aggregate	1,500	1,808
To which add:		
From Independence to St. Louis, (est.)..	217	251
St. Louis to Wheeling	496	575
Wheeling to Cumberland.....	177	205
Cumberland to New York.....	312	363
	2,702	3,202

The distance from sea to sea, then, by this route, may be taken at 2,700 equatorial, or 3,200 English miles; which is just about *one-fourth* of the distance, rendered possible in its employment, as a new road from Europe to China, and about *one-fifth* of the length of voyage now necessary by the Cape of Good Hope. It can now

be better understood what was said just now as to this continental route forming, by its entirely new relations to commerce, an independent part of the circumnavigation of the globe, if not an integral system, of itself. And its importance can be easily appreciated when we see that, in reducing the distance for Indo-European commerce to nearly two-thirds of what is possible at present, it does much more than can be claimed for any of the other routes; while so far as time of transit is concerned, it defies all competition. But I shall take up these considerations, which belong to the policy of the question, hereafter.

Returning, then, to the special route between Independence and the Pacific, the culminating point of the line near Santa Fé is but 7,047 feet above tide, by barometric measurement; which, however, cannot be relied on nearer than one per cent. of the given altitude without more correction than, as it appears, the observations hitherto taken have given elements for. But the numbers, with their maximum correction even, would not materially vary the results. I have taken the pains to go over, station by station, the heights and distances which have been given by the different observers, Emory, Frémont, and Wislezenus; and I am thus enabled to present the following synopsis of grades, making no allowances for sinuosities, by which it is easy to see they would be proportionably and, in some points, necessarily and greatly reduced. I have been obliged to make an adjustment of nine miles in the following first class, on account of an error in the printed document; which I did not at first observe, nor until after I had completed the most laborious part of the comparison. There will probably be, then, the following classes of grades and distances along the whole line.

	Ascending.	Descending.	
Between 0 and 26.4 feet per mile..	564	913	Eng. miles.
26.4 and 52.8 " " ..	148	97	"
52.8 " 79.2 " " ..	43	24	"
81 " 92 2 respectively	4	5	"
113.....	10	0	"
	769	1,039	Eng. miles.

The distances, ascending and descending, balance one another so nearly, (the later exceeding only by 3 per cent. the former,) when duly corrected for the classes to which they respectively belong, that there is no occasion for entering into the details of rise and fall; but the culminating point at Santa Fé may be taken as the average height to which freights will have to be lifted, and the distances equated accordingly. We are warranted, then, by the above statement, to conclude that there are no difficulties in the way, so far as grades are concerned. And although one part (which, however, it would appear from the topography of the maps, that have been published, is not necessarily to be occupied in reaching the Pacific from the head of the Bay of California) does reach a

limit in rise that would render an assistant engine necessary for full loads on other parts of the road; all these other parts are within, and four-fifths far within, the ratio of rise and fall that has been habitual in such constructions. In point of fact, the average grade over the whole route is but 8.1 feet per mile English, ascending and descending; a deviation from a level, which hardly affects the adhesion of a locomotive engine. As to the remaining 1,200 miles, to connect with the Atlantic, their rise and fall is within the absolute height of the culminating point at Santa Fé; so that this particular does not require farther discussion. Of these 1,200 miles, 312 are already done from New York to Cumberland, in Maryland; 177 miles more, to Wheeling, are at this moment being prepared for contract; and the remaining 513 miles, which have been long since demanded and planned by the necessities of our internal commerce, will shortly exist without any connexion as is here proposed, and need only a reasonable certainty of such connexion to be taken up and executed at once by private enterprise. In respect to the harbor at the western terminus, the inconveniences are much less than in the other instances which I have had occasion to mention. A depth of 20 feet at low water, in a bay of some four or five miles wide with secure anchorage and perfect security from winds in any direction, makes of San Diego one of the best harbors on the whole Pacific coast—"preferable, in the opinion of some navy officers, even to that of San Francisco."

Such are the technical details proper to be given here as to this scheme. As I shall refer to it again in other aspects, I pass on now to the consideration of the last route which I shall include here, and the most northern that has been proposed.

15. This route was first suggested in 1844–'5 by Mr. Whitney; and as it has had the advantage already of extensive elucidation and emphasis, both in the publications of its author and in the documents that belonged to its consideration by Congress, I need only treat of it in the most general manner. It is proposed to commence a railroad at the head of navigation in the Columbia river, 120 miles from its mouth, about latitude 46°, and to pursue the valley of that stream and of its southern branch, or Lewis's Fork, to the South Pass of the Rocky mountains, in latitude 42° 30′, nearly. There, the head of the waters for the Pacific are separated by an almost imperceptible swell from those that go to the Gulf of Mexico; and over this and, in general, along the north fork of the Platte or Nebraska river, the road is to be conducted to cross the Missouri above the junction of the Platte and still keeping on, the Mississippi above the junction of the Wisconsin, and finally to terminate on Lake Michigan, at Milwaukie or Chicago or some other as yet undetermined point. From here, no particular prevision seems to have been made; but it is stated that "England could make her depôt in Montreal or some point in Upper Canada, use the lakes, then the railroad to the Pacific, then her own vessels again." I believe that the policy of terminating at Lake Michi-

gan was connected with the peculiar plan on which the means to build the road reposed.

To obtain the distance from sea to sea, for comparison with the other routes, we are obliged, in this vagueness of terminus, to assume a continued construction of a similar means of conveyance from Chicago, by the nearest route in time, through Indianapolis, and thence to New York, identical with the last route. Under this assumption, we have, then,

	Equatorial miles.	English miles.
From the mouth of the Columbia to the Missouri	1,770	2,050
From thence to Chicago	604	700
From thence to Wheeling	420	486
From thence to New York	490	568
	3,284	3,804

There are no details for determining the rise and fall in this route, though, from the inequality of the distances on the two sides of the summit, they could scarcely be expected to balance in this particular. We can, therefore, only take the culmination at the South Pass, viz: 7,490 feet, as the height to which freights will have to be lifted. The western terminus of this route is not fortunate in its harbor. This, to be sure, has been a point that has already led to extensive discussion; and I have read over the documents that belong to the opposite views of both sides without coming to a conclusion other than what I have given, with this also, that a part at least of the importance attached to the difference of opinion arose from the circumstance of Oregon being at the time our only Pacific territory. The mouth of the Columbia river now would hardly be compared as a harbor with San Francisco, Monterey, or San Diego. It seems to have been admitted that the navigation of this river, whose extent is variously stated at 120 and 140 miles to the rapids, is only sufficient for vessels of 13 feet draught. According to Mr. Howison, the latest observer, "some parts of the tortuous channel (from Tongue Point for ten miles upward) are not over ten feet deep at low water." The embouchure, seven English miles in width, resembles more a bay than a river; and its bar, holding 24 feet at low water, is at least as deep and as wide as that of the New York harbor. But the shoals and sand-spits at the entrance do not appear to be permanent; and to these changes may be ascribed the discrepancies of different accounts. It is to be hoped that Mr. McCulloch, who appears to have drawn from the narrative of the United States Exploring Expedition, is more emphatic than accurate, when he says that "the entrance of the river is impracticable for two-thirds of the year, during which time it is equally dangerous to leave it." Other particulars, such as the climate of the country through which the road would pass and must find austere in such comparatively

high latitudes; the embarrassment from snows that might be expected to lie in those gorges, whose summits glitter with perpetual ice; the absence of coal in quantity and quality suitable for the supply of locomotives, &c., &c., are not, in favorable accounts of this scheme, supposed sufficiently probable or sufficiently material to counterbalance its merits in other regards.

After all these details, I now present for clearer illustration and comparison the following table of the principal particulars known about the various routes, so far as they are capable of being expressed in numbers:

Table of the different Routes for connecting the Atlantic and Pacific.

No.	Places.		Harbor.		Depth, proport. to New York.	Summit above tide, in English feet.	Distance from sea to sea in equat'al miles.	
	Atlantic.	Pacific.	Atlantic.	Pacific.			Total.	In fast land.
1	Port St. Julian	Eyre sound	No bar—safe				334	64
2	Gulf of St. George	Aysen inlet	..do.				295	285
3	Mouth of Rio Negro	Valdivia		Superb.				50
	....do.....do.	Ancud bay					630	10
4	Para	Lima	No bar	No bar		15,000	2,300	
5	Mouth of Atrato river	San Juan		...do		0?	225	3
6	.....do.....do.	Cupica bay		Superb		0?	125	20
7	Mandinga bay	Mouth of Chiapo river	Good				25	
8	Chagres	Chorera	12.5 feet—exposed	Exposed		35.4 to 460	45	25
	...do	Panama	.....do....do.	16 feet—exposed	0.6	....do....	45	31
9	...do	Mouth of Nata river	.....do....do.	12 feet		....do....	55	27
10	Boca del Toro	Chiriqui	Excellent	Excellent			35	35
11	San Juan de Nicaragua	San Juan del Sur		Not enter'ble always	1.0	272	121	16
12	Honduras bay	Fonseca bay						
13	Huasacualco river	Tehuantepec bay	17 feet—exposed	9—exposed	0.5	650	125	
14	New York	San Diego	24 feet	20—excellent	0.9	7,047	2,700	1,500
15	....do	Mouth of Columbia	24 feet	24 on bar—13 in river	1.0	7,490	3,284	2,630

Of all these fifteen routes, there are only five in relation to which we have elements at all adequate to a satisfactory comparison. I have therefore taken these, and present some of the details and results in the following table :

Table of average and proportionate Distances by several Routes.

No.	Route.	Length equated for difference of level.	Mean distance to Canton, forth and back.		Proportionate advantage.		Resulting proportion.
			From London.	From N. York.	European.	American.	
		Miles.	*Miles.*	*Miles.*			
8	Through Panama	46	15,054	12,624	0.979	1.161	1.14
11	Lake of Nicaragua	130	14,665	12,298	1.005	1.192	1.20
13	Tehuantepec	147	13,899	11,655	1.061	1.258	1.33
14	San Diego	2,935	13,983	10,783	1.054	1.359	1.43
15	Mouth of Columbia	3,534	14,522	11,322	1.015	1.295	1.31
	Cape of Good Hope	.....	14,741	11,659	1.000	1.000	1.00

It is manifest from this table that, so far as European commerce is concerned, (of which London may be taken as the focus, as Canton may of the Indian trade,) none of the routes possess an advantage in saving distance over the existing one by the Cape of Good Hope, likely to balance the expense and inconvenience of transhipment. With Indo-American commerce, (considering New York as its focus,) an advantageous economy of distance above the best existing route is presented by each and all, varying from 16 per cent. in the case of Panama, to 36 per cent. in the case of San Diego. When the respective proportions are combined, however, as they must be, of course, to indicate the ultimate effect upon the commerce of both continents with Asia, and the probable merit of the various routes as far as their distances are concerned, the route by Panama becomes but one-seventh, while that by San Diego is nearly one-half better than the voyage round the Cape of Good Hope.

I believe I need not explain farther the propriety in the choice of these trade-centres, or why I have not taken distances also to and from other points in all three continents. In regard to this last consideration, the number of points which should be taken according to a strict theory would be infinite; and, while the labor of reducing all these to a separate numerical ratio for each would be inexpressibly tedious, it is easy to see in advance that, if the distribution of land and water over the globe were equal, the aggregate of all the ratios by each route would be equal too. This is one of the cases in which the application of a strict geometrical theory to questions of political economy, would apparently defeat the very aim of the inquiry.

But about the distances which are given, a few words of explanation may be necessary, especially as this very particular has been already a subject of discrepancy and discussion, and as the present table affords results differing somewhat from the generally preconceived opinion. These distances, then, are the sums of measurements, made on a 21-inch globe, of the shortest line between points, given in longitude and latitude, which have been actually and consecutively reached by vessels in their circumnavigation of the earth. They are not perhaps the shortest possible distances between the extreme points, respectively; but I am assured that they are possible in all seasonable voyages to reasonable intelligence and skill. Due regard has been paid, of course, to prevailing winds and currents; and so, for instance, the voyages out and home (in, I believe, every case but one) are of different lengths. The numbers given are the means of these lengths, as expressed in the caption to the table. I am informed and so consider, therefore, the points so given as the result of actual experience; the measurements between them, I can only aver upon my own responsibility and the pains which I took to be accurate. If I do not mention here the very respectable source from which I derived information on a matter foreign to my own professional experience, it is from any other reason than that it might not be recognised by

those familiar with nautical matters in at least as high a degree as I estimate it myself.

Taking these distances as reliable, I have gone on to construct another table showing the *time* that will be probably required over the several routes. This, which is the most important practical element, would also serve as the sole index in theoretical comparisons, if the means and rapidity of transport were uniform or invariable. But they are very well known as not being so; and the *time*, consequently, as a variable element, should always be taken in connexion with the absolute distance that serves as the limit of variation. For the present purpose, I have assumed that the duty of a sailing vessel is 110 equatorial miles per day, and of a railroad locomotive 25 miles per hour; also, I allow 12 days as a reasonable time, with a proper system, for discharging a ship of average burden, say 600 tons—loading the cargo on the railroad on the Atlantic side, for instance, and unloading and reshipping at the other extremity. This 12 days is, therefore, a constant to be added in to every route; and the results, whose numerical details may be dispensed with, I present in the next table. I have omitted in it any calculation predicated upon the use of steam in ocean navigation; for such use, though it would lessen the absolute time required by all routes, would work proportionately more in favor of the present African route, and accuse a difference still more marked against the others. These others, therefore, show to their best advantage in the following:

Time table of several Routes.

No.	Route.	Average time in days to Canton.		Proportionate gain or loss in time.		Resulting proportion.
		From London.	From N. York.	From Europe.	From America.	
	Through					
8	Panama	148.5	125.5	0.902	1.062	0.96
11	Nicaragua	144.3	122.8	0.929	1.085	1.01
13	Tehuantepec	137.2	116.9	0.999	1.140	1.14
14	San Diego	117.3	88.2	1.142	1.510	1.73
15	Mouth of Columbia	126.9	88.7	1.056	1.500	1.59
	Cape of Good Hope	134.	133.3	1.000	1.000	1.00

In this table the factor representing the proportionate advantage of each route, which is of course inversely as the time required in passing over it, is somewhat modified from what was derived in the table of average distances. The ultimate resultant, however, still follows the same order and exhibits similar relations among the several routes, with the exception of that by the Columbia

river, which is here shown to have nearly 40 per cent. advantage over the Tehuantepec line, although the latter is in actual equated distance the shorter of the two. The general conclusion from both tables is confirmatory of what Mr. Stephens has long since observed, (and what he was one of the first, I believe, to observe,) viz., that the isthmus-routes, if constructed, would not be availed of for European trade on account of any saving in *distance* nor, it may be added more emphatically, of *time;* and the factors belonging to these isthmus-routes, especially in this last table, show so little advantage in them over the existing way by the Cape of Good Hope as, I think, justly to exclude them from any further consideration in comparison with the internal routes across the continent. The question, then, is narrowed down to a comparison between these last; either of which is seen to afford a route, after all allowance made, nearly twice as advantageous for the trade of the world (excluding southern Africa) as the voyage round the African continent and over the Indian ocean. What remains to be said applies to such a comparison continued in the following table; in which the respective advantages in distance and time, that had to be kept separate in contrasting with routes having no effect upon the internal commerce of the United States, are combined in one resultant, and still further modified by multiplication into the indices of the only other element that can be valued numerically—that of *cost.* In regard to this particular, it must be observed that the estimate for the road by way of the lakes, the South Pass, and Columbia river, is only $20,000 per English mile; which is less than half the average cost of existing successful railroads in this country. There may be, of course, peculiar circumstances of topography and geology which warrant now and may verify hereafter this estimate; but I apprehend that engineers, without ascertainment of these circumstances, would not like to endorse an estimate so much against experience elsewhere; and I may observe that $5,000 (the proportion set apart for graduation alone) cannot be expected to do much earth-work even, let alone the masonry and bridging that will occur on a line where such rivers as the Mississippi and the Missouri and the Nebraska have to be crossed. For the other route, therefore, by St. Louis, Santa Fé and San Diego, I prefer to conform to a more probable datum of $40,000 per mile. In order to express the proportions rigidly, it is manifest that in the absence of positive information, the two roads ought to be represented by the same factor per mile; but as I do not feel authorized to change arbitrarily Mr. Whitney's estimate, nor inclined to alter my own, what has been said will be enough, I suppose, to prevent an erroneous impression as to this particular. It is partly for the same reason, and partly for others more general, that I make no use, beyond the mere statement, of the estimated *time* required for construction. It may be said in general that whenever any object is decided to be good or desirable, the sooner it is attained the better it is; and although a mathematical calculation could not be based entirely upon these elements, it may even be said popularly and correctly that of two roads equal in other regards of present and

future utility, the one that can be built in seven years is twice as good as the other which takes fifteen years. But as in the present case these are mere *estimates*, either of them, and the longer time supposed by Mr. Whitney may originate in the peculiar policy which he suggests in its construction, it would be unfair to make them factors in a numerical analysis.

I now present the table spoken of:

Route.	Proportion. advantage.		Resultant.	Estimated cost.		General resultant.	Time before completion.
	In distance.	In time.		Absolute.	Proportional.		
							Years.
San Diego.....	1.4332	1.7250	1.—	60,000,000	1.—	1.—	7
Mouth of Columbia	1.3143	1.5863	0.844	65,000,000	0.923	0.779	15

It is hardly necessary to suggest here a caution against a possible error into which a hasty reader might fall, in inspecting this and the preceding tables, by mingling the direct and inverse proportions. All of these last have been reduced so that the columns of proportions exhibit the direct probabilities in favor of each route under their respective categories; and this without regard to the order in which they may happen to come. Thus, in this last table, the fourth column shows, by the combined categories of commercial distance and time, the Columbia river line to be nearly 16 per cent. worse than the other; if the cost of both lines were the same, it would continue to be thus much inferior; but as it costs more, it is again on this account not so good, and that in the proportion of the costs, respectively; so that the final proportion, upon all the combined probabilities, establishes the San Diego line as being nearly 36 per cent. more advantageous than, and in so far to be preferred to, its rival.

I may also properly add one word in respect to the *commercial distance*, which enters as an element in the proportions, and which is to be distinguished from the *absolute length* of the lines to be constructed. So far as any given line is absolutely longer than any other given one, it is disadvantageous; this is an inverse element measured by and allowed for in the *cost*. At the same time, so far as the longer line passes through and accommodates a greater extent of territory, it is advantageous; and this is a direct element which is allowed for in the *time*. The combination of the two is the index for the *commercial distance*, as I have employed it. I believe that those versed in such analyses will not discover any error in the principles which I have applied, or in their reduction. In regard to this last, I may say, for the benefit of others, that the nearness of the numbers (and even fractions) employed, is no fastidious affectation of accuracy. These numbers were in the first instance given

by actual measurement; and there would have been hardly more propriety in altering them so as to give *round* numbers, than there would have been in making the measurements themselves roughly or carelessly, or in substituting other numbers arising from fancy or hearsay or no measurement at all. And the fractional reductions, which did not in my methods increase the labor of calculation, were necessary to the aim which I had in view.

The principles that have been referred to, too, are the more worthy of attention; since, as it seems to me, they have been sometimes misunderstood and misapplied; not lately only, but frequently hitherto in the schemes for uniting the Atlantic and Pacific. It has been supposed, for example, that the commercial focus of the world would be, in the execution of some one or other of these schemes, translated from Europe to America—from London to New York; and that immediately, or very shortly. But it should be considered in such supposition, that *commerce* is the meeting of those who buy and those who sell—of those who produce and those who consume. That point, then, upon the surface of the globe, which affords the greatest facility for such meeting, is the commercial focus of the globe. Such a point, London is at present. That there may be a translation hereafter to New York, is neither to be affirmed nor denied. Whenever New York shall come to exceed London in ships, in population and in thrift, the translation will have been effected; but not till then. So that the necessity is apparent of considering the Indo-European radii of trade, in any equation among different routes for connecting the two great oceans; and to New York has been assigned due prominence in considering it as the centre of the Indo-American commerce. But whatever may be the effect of the laws of trade on this question, I am dispensed from the occasion of considering it farther here; inasmuch as in the two routes now compared, the operation and issue must be identical, or nearly so; and the eastern terminus of both, in New York, will (become not the *depôt*, most likely, for a long time, but) the *entrepôt* of the trade of southeastern Asia with the rest of the world.

To return, then, to the comparison of the two routes, it must be said that if any reliance can be placed upon *figures*, which (Mr. Humboldt has justly remarked) are the final and inflexible judges in politico-economical cases as well as among the physical phenomena of Nature, there can be no hesitation as to which should be preferred. At least, there will have to be a good deal more force and precision than are generally to be found in the somewhat vague conclusions of political economy (so far as they do not rest on mathematical analysis) to countervail the decision which the preceding tables indicate. Besides, all the sanguine expectations and glowing pictures (vague and fleeting as they may be) of the future destiny of the upper route, belong with more correctness and more effect to that by Santa Fé and San Diego; and all the arguments of constitutional power and political expediency which have been so abundantly and frequently adduced in favor of the former by its projector and its friends, apply with more emphasis to the latter.

If we take only this consideration, which I believe is well recognised as a principle in political economy, that in the application of national funds, that direction is always to be preferred *which will lead to the greatest beneficial result in the same time*, there is no further need of contrast. The upper line would pass through a country and climate, inhospitable, austere; domineered over by wild tribes, the Snakes and the Nez-Percés, whose very names symbolize their barbarity and guile. The Santa Fé line goes over a territory fertile, and peopled aboriginally with a milder race; where the soil produces, as along the Rio Grande, two crops in the year; where, for more than two centuries, the labors of the missionary and merchant have met, each, with their return; a country of coal and of gold. If, then, the expenditure of a given amount of money toward developing and improving the physical and social resources of this part of our country, be not successful in a shorter time, and do not produce greater and more beneficial results in the same time, than when scattered over the harsh and desolate regions of the upper Rocky mountains, it will be a signal discomfiture of all ordinary probabilities; which one may be excused for not anticipating.

Lest the pursuit of the contrast might be misconstrued into an invidious and disparaging argument against routes other than the one about which I have been seeking the most exact methods at command to fortify my prepossession, I shall indicate but one more point of difference between the present two, which is worthy of consideration and, alone, might be enough to influence the decision. The peculiar method (to which I have already adverted) proposed for the construction of the upper line, is the cession, by the United States, to the projector and his heirs, of a large amount of public lands lying on each side of the line; to be used by that party, in concert with trustees appointed by the Government, as a property whose sale is to furnish the funds for building the road. This is, in fact, to tie up about 100,000,000 acres of the public domain for a period of (I believe) 20 years; or, rather, it is to give in advance these 100,000,000 acres for the chance of having the road made. Now, it is to be observed upon this, that, if a private individual can carry out the scheme with the proceeds of these lands, the United States can certainly do it as well, themselves. Farther, if the proceeds of these lands be, as it is presumed likely, more than sufficient to build the road, the overplus goes to the heirs of the projector, who, of course, are entitled to compensation for their services; this overplus, as the United States already have found and paid their trustees for superintending the sales, would be saved to the Nation by doing the work themselves. If, on the other hand, the proceeds should not be sufficient, who will make up the deficiency? Farther, besides the utter opposition of such a precedent for enormous individual proprietorship of lands to the spirit of our constitution, this scheme includes, and introduces even, all the risks that attend efforts to have work done without *money*, all the disadvantages that attend a merely private enterprise, (greater in proportion as it is complicated and vast,) and all the failures of ne-

gotiation and disruption of plans, which are not unlikely in a concern managed by two parties having different views and separate interests. These appear to me grave objections. They do not apply at all, however, to the other line; for which I would recommend a system quite the opposite, viz: That the United States construct it themselves, as they made the National Road—an epithet that belongs to this in a wider and more emphatic sense. The account for its construction might be balanced, from time to time, by the proceeds of the public lands in New Mexico and California, to whose settlement it would so materially contribute; but without setting apart any particular district for the purpose, or restricting the free exercise of discretion in the General Land Office to sell any part of the public domain, at such times, and in such quantities, and for such prices, as might be judged best. These sales, with the proceeds of a royalty that might be expedient on other considerations for the United States to establish over the California gold and quicksilver-mines, would be, it is probable, quite sufficient, after a small advance of money at the beginning, to maintain the energetic prosecution of the work, and to insure its due economy by the payment of cash or its equivalent. The effect, too, of this system would be very marked and very different from the other, in the stimulus and security that it would give to private undertakers to finish the chain between Independence and Wheeling. It is quite likely that individuals, wanting full confidence in so complex and tedious an undertaking as that contemplated for the northern route, would postpone their exertions to connect Chicago and Wheeling until events had shown that their confidence might be justly placed in it; if the United States undertook the work, the closing of the line would be immediate. By the cession of lands, then, to an individual, the connections through Ohio, Indiana, and Illinois, would be neither guaranteed nor stimulated; by the undertaking of the Santa Fé railroad on the part of the United States, a railroad-transportation between the Ohio and Mississippi would be placed at once in the category of works in progress.

The importance of the San Diego railroad, then, and its probable efficiency above all other routes that have been proposed, upon the commerce, both foreign and domestic, of the United States, have, it seems to me, been demonstrated in a light sufficiently clear by what has been said. It only remains now to mention one or two other topics intimately connected with the subject.

The first of these is its influence in the proper administration of our government which, without some such adjunct, extends itself but in form beyond the Rio Grande, and grows obsolete before reaching the meridian of Santa Fé. Farther west than that, by nearly 800 miles, our territory extends; and on the shores of the Pacific, we have a line of sea-coast of 1,200 miles. All this is, at least, to be *defended;* and for defence, forewarning is forearming. We must, necessarily, keep up an uninterrupted and speedy means of intercourse. How far these conditions of intercourse are obtained by the tedious voyage round Cape Horn, or even by the

proposed improvement of some one or other of the isthmus-routes through a foreign and, probably at some time, inimical territory, I shall not stop to inquire; it is plain that either four months or forty days in the transportation of munitions and troops after the receipt of advices here, (which could not be brought, even by regular relays of overland express riders day and night and by telegraph, under ten days,) leave the territory there and its inhabitants entirely without defence, either against foreign aggressors or barbaric neighbors. The construction of a railroad to San Diego would place this particular in quite another aspect. Accompanied, as such a line would have to be for part of its own police, by a system of telegraph-wires, news could come from there and replies return in every day; while, in case of need, from all our Atlantic board, forces and supplies in unlimited amount could be transmitted in four days. Ordinary travel from New York would accomplish the journey in six.

Considered in another light, such a road is invested with a still deeper interest. Three thousand miles and more now interpose between the extremities of our territory, and separate citizens of the same Republic; some of whom are watching the current of the St. Lawrence, while others are waiting for the tides of the Pacific. It is impossible but that such remoteness of space and association will, unremedied, leave room for the gravitating tendency of social, like inorganic, masses to fall apart. Such a connection as I propose is the only remedy against such a disaster; and a line like this will be a bond of union stronger, in a moral sense, than the iron material with which it is physically laid.

Nor is it likely that these benefits, so striking and so pervading, will be obtained at any material annual charge to the nation, even if the very enterprise does not turn out to be, at ordinary charges, lucrative. I do not think that the tonnage passing over the road in the first year after its completion is extravagantly estimated at 100,000 tons through; which, at the usual railroad freights of 3 cents per ton per mile, would be upwards of $4,000,000. And if the reports which we are hearing of Upper California are half true only, and if the deposites of precious metal there do not belie the hitherto received geological habitudes of such formations, seven years hence this El Dorado of the West will be only in its prime, and the field for adventure and success will be but more ample and more assured. And when this begins to be narrower or uncertain, there is, below, the rich mining district of Sonora, whose wealth has hitherto been shut up by the marauding Apaches. In this respect, San Diego will not improbably turn out to be nearly the central point of a great auriferous region whose yield will once more repeat the drama of the sixteenth century, and roll the current of the precious metals, which is now setting eastward from the slopes of the Ural, back again from the west. I do not suppose, therefore, in view of all this, and of the existing current of travel over our present roads, that 150,000 persons per annum would be too high an estimate for the probable travel over this road. The fares from this, at the habitual charge, would be rather more than $4,000,000;

and as, conformably to experience on a reasonably well managed road, one-half of the gross receipts may be relied on as net profits, we would thus have a clear revenue of more than 6 per cent. per annum on the whole investment. I have adduced these numerical estimates in order to show that, as far as can be conjectured, the probabilities are rather in favor of the enterprise not resulting in any sunken capital.

Finally, in whatever light we regard this proposed road—whether in the lowest sense of mere lucre to a party possessing sufficient wealth to undertake and complete the enterprise; or in a sense a little higher, of its being an instrument to facilitate and expand our internal and external commerce, and to influence even the trade of the world; or in an aspect more elevated, of a means for performing a duty in defending our own citizens and their possessions, and in hastening the peopling and civilizing of our territories; or in a phase, the loftiest yet, of a ligament potent in holding together our Union as a nation, and in prolonging and perpetuating the duration of a republic, the freest and happiest, in spite of local and accidental frictions, that the world has known—in each and all of these senses, it commends itself to prompt consideration and execution.

BALTIMORE, *February* 6, 1849.

RAILROAD

FROM

THE MISSISSIPPI VALLEY

TO

THE PORTS OF SAN DIEGO, MONTEREY, AND SAN FRANCISCO:

ALSO,

The connexion of this road with those of the Atlantic States leading west as far as the valley of the Mississippi,

BY ROBERT MILLS,

ENGINEER AND ARCHITECT, WASHINGTON CITY.

The map accompanying this paper exhibits the topography of the country between the valley of the Mississippi and the Pacific ocean, included within the latitudes 25° and 42°, and longitude 75° and 123° west of Greenwich observatory, or 46° west of Washington. The straight lines drawn in red from St. Louis on the Mississippi, and from Memphis to San Diego on the Pacific, show the bearings and distances, in straight lines, between these points. The blue lines between the same points, designate the probable route of the proposed road from the valley of the Mississippi to the Pacific ocean, terminating at San Diego, with a branch to San Francisco and Monterey. Other branches are also laid down, showing the connection of this road with the Guaymas on the Huaqui river, Gulf of California, with Texas and with New Orleans.

By reference to the two points of the Mississippi from which the road would start, namely, St Louis in latitude 38° 37′ 28″ north, and longitudge 13° 13′ 52″ west of Washington, and Memphis in latitude 35° 10′ north, and longitude 13° 10′ west of Washington, San Diego in latitude 32° 45′ north, and longitude 40° 9′ 36″ west of Washington, distant from St. Louis in a straight line, 1,782 miles, and from Memphis, 1,710 miles; the general course to San Diego from St. Louis, is west 6° 5′, and from Memphis, west 3° 5′. The terminus at St. Louis will connect with all the railroads coming from the north, east, and southeast, as low down as Richmond on the sea board, and the terminus at Memphis will connect with all the railroads coming from south of Richmond, Charleston, Savannah, and round by the Gulf of Mexico, as low down as New Orleans. Thus these two main branches will equalize the commercial interests of the States on the sea board, and by these branches intersecting the Mississippi, upper and lower, those of all the Western States

by means of this noble river. The distance from St. Louis, by the northern branch, to the sea board cities may be stated as follows: passing through the States of Illinois, Indiana, Ohio, and Kentucky, this main branch will be met: 1st, by the roads leading from New York and Boston, the first 1,082 miles, the second 1,200 miles; 2d, the roads leading from Philadelphia 1,000 miles, Baltimore 890 miles, Washington 856 miles, Richmond 900 miles; the distance from Memphis, the southern branch, to the sea board cities may be stated thus: passing through the States of Tennessee, Mississippi, Alabama, Georgia, South Carolina, this main branch will be met: 1st, by the roads leading from Charleston 700 miles, Savannah 650 miles, Tallahassee 500 miles, Pensacola 350 miles, Mobile 300 miles, New Orleans 396 miles, &c.; thus every shipping port on the Atlantic, would be connected with these main branches at St. Louis and Mempis, and by these with the Pacific. It will be seen, by reference to the map, that several branches from the main stem of this road are laid down, one passing down the valley of the Red river by Fort Towson Natchez, to New Orleans, another through Texas by the valley of the Brazos or Trinity, through Austin, Washington, Houston, to Galveston; another west of the Rio del Norte, down the valley of the Huaqui river to Guaymas on the Gulf of California.

The admirable topography of the country between the valley of of the Mississippi and the Pacific ocean for a railroad will be manifest by examining the map; the rivers emptying into the Mississippi all flow from the west, and the intermediate spaces made up of prairie lands. The road would mostly be located along the ridges or valleys of these rivers; the only stream of importance to cross before entering the valley of the Gila river, (emptying into the Pacific waters,) is the Rio del Norte; after crossing which, a beaten wagon track, mostly through a prairie region, will be found nearly all the way to San Diego; these facts give assurance of the facilities afforded by this country for a railroad.

The whole of this region between the valley of the Mississippi and Pacific ocean has been so recently explored, during our military occupancy of the country, and by our traders for years past, that the practicability of carrying a railroad through it is no longer a question. From all the topographical information we have received from our talented and enterprising engineers and scientific travellers, we can no longer doubt of the feasibility of constructing such a road way; and of its *expediency*, the public interests, and the vast trade waiting to be carried over it, must be the answer. The commerce of Europe with Asia, in which we do not now participate to the value of one dollar, amounts to an aggregate annually of $250,000,000, employing about two thousand ships, of a tonnage in weight of at least 1,200,000, and employing about five thousand seamen. All this immense commerce would be changed to this new route, and at the tolls above named—one half cent per ton weight per mile—would give to this road $12,180,000 per annum; and to the roads leading to and connecting with it from the Atlantic and gulf cities, $12,000,000 more; making the sum of $24,180,000 per annum, which the commerce of Europe with Asia

would be tributary to us alone for transit across our continent, and which is small compared with all the other advantages to grow out of and be subject to it; so that it is possible the road would not be able to accommodate all the business now ready for it, but not probable there would not be business enough to support it.

The barometrical observations made by the several scientific corps that have traversed this country show that little difficulty, in respect to grading the road, will occur, and that the maximum speed on such roads can be attained the whole route; the elevation of the point of starting at St. Louis is about 700 feet above the sea; the valley of the Arkansas, 3,000 feet; the crossing of the Rio Grande or Del Norte, 4,000 feet; the entrance of the Gila valley, 4,600 feet, from which point this valley gradually descends the whole way to its discharge into the Rio Colorado of the west, nearly level with the sea; from thence it gradually rises the valleys of the dividing ridge, (the Cordilleras of California,) the Sierra Navada, and then descends to San Diego, on the sea coast, at tide water level.

Thus we see, from the peculiar character of country traversed by this road, mostly prairie, its practicability is insured, and that at an expense not greater than the cost per mile on other railroads. Colonel Cooke, of the 2d United States dragoons, who conducted a train of wagons through the most difficult part of the proposed route, namely, from the Rio del Norte to San Diego, thus writes to Colonel J. J. Abert, of the topographical bureau:

WASHINGTON, *December* 6, 1847.

SIR: I have the honor, at your request, to address you a brief memoir on the subject of the district of country in Sonora, Mexico, which I passed over in November and December last with a wagon train, when I deviated in search of a practicable route from the mule trail of Brigadier General S. W. Kearny, on his march from New Mexico to California.

When he turned off from the Rio Grande opposite the copper mines and the heads of the Gila river, I kept the river for thirty miles to the south, and, making a southern bend, turned again towards the north, and struck his route (as surveyed by Mr. Emory, of your corps) just above the village of the Pimo and Maracopa Indians; an estimated distance of 444 miles.

Immediately below the point of deviation on the Rio Grande the country bordering the river became sensibly flatter and less broken. I left the river when in view of a point marked on the common maps as San Diego, and the distant view towards *El Paso proved the country to be unbroken and comparatively level.*

From the high valley of the river I ascended to the table land of Mexico, by an almost insensible slope over smooth prairie. For 150 miles on this smooth level table land, which is studded with isolated hills or mountains, I journeyed without any difficulty, passing over but three hills; in two cases (I know in the third) I believe unnecessarily. I then unexpectedly and suddenly arrived

at a great break off to a lower level of country, the descent to which was very broken, and rough mountains for fifteen miles. I found, however, that I had at that moment fallen into an old wagon trail, which led, I was told, from Yanos. I was able to get my wagons through, following a stream all the way, and descending in the fifteen miles possibly one thousand feet. This was the head of the Huaqui river, which empties into the California gulf; I was told that this was called the Pass of Guadaloupe.

I then passed an unbroken country, about eighty miles, when I fell upon the Jose Pedro river, which empties into the Gila. I descended this, without difficulty of ground, about eighty miles. In turning off there is an ascent to nearly level country of, perhaps, above an hundred feet; but it could be made very gradual. It is then about forty-eight miles to Tueson, a town of about five hundred inhabitants, with a fort and garrison; this distance is over much smooth ground, maintaining the same general level. Tueson is in a rich and well cultivated valley, where there is also a dense forest of maguay. From Tueson it is some seventy-five miles to the Gila; it is a level plain, generally of clay, where my wagons and footmen (water being very scarce) passed at the rate of about thirty miles a day.

On the map which I made, and which is in your bureau, is marked a route considerably to the north of Guadaloupe pass, *which some of my guides believed would avoid that broken descent, and found to be nearly level throughout to San Pedro*, at the point where I turned off from that beautiful little river. The most sensible and experienced of these men, Laroux, who lives in Taos, New Mexico, and who had trapped on the Gila, and passed in a different direction over that country, was decidedly of this opinion. But his knowledge, on the other hand, was sufficient to forbid to explore it in my situation on account of scarcity of water.

The Rio Grande bottoms, for a hundred miles above and at the point where I left, are well timbered. There is no timber on the table land, save upon the small mountains which are everywhere to be seen. This is cedar and pine, but of small growth. Rock is everywhere to be had; secondary rocks of almost every kind; *but by this wonderfully level route, the continent may be passed with scarcely a view of granite.* As far as Tueson, the gramma grass is abundant; it will fatten cattle while working, and in winter. The route from Tueson passes through a country abounding in exceedingly rich gold mines.

I am very respectfully, sir, your obedient servant,

P. ST. GEO. COOKE,
Major 2d Dragoons.

To Col. J. J. Abert,
Topographical Engineers.

And with regard to that section of country lying between the Mississippi and Rio del Norte valleys, we have many accounts of trails favorable to our road; and recently Lieutenant Burford, of the United States dragoons, left Fort Smith, with his command, by the

Canadian trail, and without the least difficulty, and in a very short time, reached Santa Fé, reporting the route he travelled as the best and shortest from the States to Sante Fé, California, and Oregon. A late writer thus speaks of the route according to the testimony of gentlemen acquainted with all the localities, and who speak from personal examinations of the entire country.

"The distance from the head of steamboat navigation on the Arkansas, to Santa Fé, is less, by about three hundred miles, than from Independence to Santa Fé. From the early opening of the spring, in the late trade of the southern route, caravans are enabled to start from a month or six weeks earlier than on the north route. The route runs mainly between the forks of the Canadian river, on the dividing ridge, which is as level as could be desired, and abounds with springs the entire distance.

"The discovery of coal which has lately been made on this route promises favorable for a rich supply; the shaft already sunk proving a thick bed, and extending over a large area."

At some suitable point of the main stem of this road, before reaching San Diego, a branch road leads off to San Francisco. That point, assumed on the map, is at the crossing at the Sierra Nevada, dividing the waters falling into the Pacific and Gulf of California, an elevated point, which may be necessary to enter the valley of San Joaquim, descends all the way to San Francisco bay. "*A canal can easily be cut* (says Mr. Farnham, who travelled through this country,) *from the head of steamboat navigation, on the San Joaquim, to the head water of the Gulf of California.* This, for commercial and warlike purposes, would be invaluable;" and, in passing down the same, a branch road may lead through some gorge in the high land west to Monterey; thus would all the important harbors on this section of the coast of the Pacific be reached. It is probable that the route of the Gila will be found the most advantageous line for a railroad even to the bay of San Francisco, by means of the San Joaquim valley, rather than by the Great Salt basin and Sacramento valley, 7° or 8° further north. The valley of the San Joaquim is about 300 miles long, and 60 broad, between the slopes of the Coast mountain and Sierra Nevada, with a general elevation of only a few hundred feet above the level of the sea. It presents a variety of soil, from dry and unproductive to well watered and luxuriantly fertile. The eastern (which is the fertile) side of the valley is intersected with numerous streams, forming large and very beautiful bottoms of fertile land, wooded principally with white oaks, (quercus longiglande, *Tor. and Frem.*,) in open groves of handsome trees, often five or six feet in diameter, and sixty to eighty feet high. Only the larger streams, which are fifty to one hundred and fifty yards wide, and drain the upper parts of the mountains, pass entirely across the valley, forming the Tulare lakes and the San Joaquim river, which, in the rainy season, make a continuous stream from the head of the valley to the bay. The foot hills of Sierra Nevada, which limit the valley, make a woodland country, diversified with undulating grounds and pretty valleys, and watered with small

streams which reach only a few miles beyond the hills, the springs which supply them not being copious enough to carry them across the plains. These afford many advantageous spots for farms, making sometimes large bottoms of rich moist land. The rolling surface of the hills presents sunny exposures, sheltered from the winds, and, having a highly favorable climate and suitable soil, are considered to be well adapted to the cultivation of the grape, and will probably become the principal vine-growing region of California.

The uplands, bordering the valleys of the large streams, are usually wooded with evergreen oaks, and the intervening plains are timbered with groves or belts of evergreen oaks, among prairie and open land. The surface of the valley consists of level plains along the Tulare lakes and San Joaquim river, changing into undulating and rolling ground nearer the foot hills of the mountains.

This stream has a deep and tranquil current; its waters are transparent and well stocked with salmon, and other fish; it is navigable for small steamboats about two hundred and fifty miles; a high range of mountains on the northeast, at an average distance of forty miles from the river, bounds its valley in that direction; and a range of hills, rather low in the north, but becoming lofty in the south, bounds it on the west, forming a prairie vale six hundred miles in length, nowhere less than forty, and often more than one hundred, miles in width. This vast plain extends, indeed, with little interruption, from the bay of San Francisco to the Colorado, gradually growing wider and wider and more uneven in its surface till it reaches that river, a space sufficient for an empire. A very large proportion of its surface is open prairie, covered with grasses and a species of wild oats; but it is so diversified by lines of trees skirting the streams, by wooded spots standing out like islands on the green plain, by arms of timber stretching far down from the mountain sides, and by extensive circular groves, connected with large forests by a thin fringe of trees, that the valley presents the appearance of a vast series of plains of every conceivable area and shape, from the little wood bound plantation to the township, the county, and the State. Over this immense plain rove innumerable bands of wild horses, mules, elk, deer, grisly bears, and other animals. The portion of the valley within twenty miles of the river is wholly uninhabited.

San Diego—its harbor, climate, &c.

It is situated at the foot of a high hill on a sand flat two miles wide, reaching from the head of San Diego bay to False bay. A high promontory of nearly the same width runs into the sea four or five miles, and is connected by the flat with the main land. The road to the hide-houses leads eastward of this promontory, and abreast of them the frigate Congress and the sloop Portsmouth are at anchor. The hide-houses are a collection of storehouses where the hides of cattle are packed before being shipped, this article forming the only trade of the little town.

The bay is a narrow arm of the sea, indenting the land some four or five miles, easily defended, and having twenty feet of water. At the lowest tide, the rise is said to be five feet, making the greatest water twenty-five feet.

South of Point Conception the climate and general appearance of the country exhibit a marked change. The coast from that cape trends almost directly east; the face of the country has a more southern exposure, and is sheltered by ranges of low mountains from the violence and chilling effect of the northwest winds; hence the climate is still more mild, and genial, fostering a richer variety of productions differing in kind from those of the northern coast.

Bay of San Francisco and climate.

The bay of San Francisco has been celebrated from the time of its first discoverers as one of the finest in the world, and is justly entitled to that character even under the seaman's view of a mere harbor; but when all the necessary advantages which belong to its fertile and picturesque dependant country, mildness and salubrity of climate, connexion with the great interior valley of the Sacramento and San Joaquim, its vast resources for ship timber, grain, and cattle; when these advantages are taken into account, with its geographical position on the line of communication with Asia, it rises into an importance far above that of a mere harbor, and deserves a particular notice in any account of maritime California. Its latitudinal position is that of Lisbon, its climate is that of southern Italy; settlements upon it for more than half a century attest its healthiness, bold shores and mountains give it grandeur, the extent and fertility of its dependant country give it great resources for agriculture, commerce, and population.

The seaward coast of the Californias, extending through twenty degrees of latitude, has only two good harbors. There are, indeed, very many roadsteads and bays where vessels anchor with considerable safety, and take in and discharge cargoes; but they are all exposed to some of the prevailing winds. The only well-protected harbor is San Diego, lying in latitude 33° 17′ north; this is land-locked, without surf, with a smooth, hard sand beach, and free from rocks and stones; but it is much less in extent and far less valuable to commerce than the bay of San Francisco.

The bay of San Francisco is the glory of the western world; its mouth lies in latitude 37° 58′; the water on the bar is eight fathoms at low tide; the mountains on either hand rise several hundred feet above the sea, and form fine landmarks in foggy weather to point out the bar and the channel into the harbor. The capes at the ocean's edge are about two miles apart, always verdant and refreshing to the eye; and as you go up the passage the little streams tumbling from the rocks among the green wood, and the wild game standing out on the cliffs or frolicking among the brush, and the seal barking in the water, give promise of pleasure and rest from the toils of the sea.

The advantages of the San Diego route, while it would equally facilitate the intercourse with San Francisco and Monterey, and, if required, with Astoria by the coast route, will be made manifest by examining the map where the line of the road crosses the Colorado river, which opens an intercourse with the Gulf of California, rich in the pearl fisheries—all the ports of the same. Besides this, there will be the commerce descending the Rio Colorado and Gila; the former of which is now navigable several hundred miles, and the latter many miles.

Between the mouth of the Colorado and the Pacific there is a region of very delightful climate. The mountains increase in height, and among them are many beautiful plains watered with abundant springs and brooks, and interspersed with many pleasant woolands, which, together, render the air charmingly temperate.

In the country between the Gila and the Colorado there is a great variety of temperature. From the junction of the two rivers, for the distance of 200 miles up the Colorado and about 100 up the Gila, the climate is exceedingly hot in summer and in winter rather frosty.

The river Gila forms the southeastern boundary of the Californias; it rises among the mountains west of Santa Fé, in latitude 36 degrees north, and running westwardly a distance of about 500 miles, falls into the Colorado about 60 miles from the Californian gulf. It is a rapid rushing stream of excellent water; its banks, like those of the Colorado, in a great degree are composed of basalt and trap rock, rising perpendicularly, much in the manner of the pallisades on the Hudson. The valleys of the upper branches of this stream are comparatively rich and beautiful. The lofty mountains, among which it rises, the higher peaks of which are covered with snow throughout the year; the bold cliffs which at irregular intervals burst up from the plains; the conical hills of rich earth clad with forests; the grass fields covered with wild animals and Indian lodges; present a panoramic view of the Gila and its neighboring lands, which invites us to expect hereafter to see them inhabited by a somewhat dense and thriving population.

MEMORANDA, FROM THE REPORT OF M. NAPOLEON GARELLA, OF A SURVEY ACROSS THE ISTHMUS OF PANAMA: 1845.

Tides.

"By careful leveling, it was ascertained that the highest tides in the Pacific at Panama are 19.09 feet above the highest tides in the Atlantic at Chagres. As the highest tides of the Pacific are 20.01 feet, whilst those of the Atlantic at Chagres are but 1.31 feet, the difference of the levels, at the lowest tides, would be reduced to 0.39 feet. By the above figures, the mean level of the Pacific would be 9.74 feet above that of the Atlantic; but the mean level of the Pacific not being constant, a mean of the observed tides has been taken, which gives 9.54 feet as the difference of height between the mean levels of the two oceans."—*Page* 80.

Termination on the Atlantic.

"The Bay of Limon, sometimes called in Spanish, 'Puerto de Naos,' situated five miles to the northeast of the mouth of the river Chagres, is of considerable extent; its entrance is 4,375 yards wide; its length north and south is 6,560 yards; and its average width, which is quite regular, is 3,281 yards. Its depth is considerable everywhere, except its southern extremity, where it is occupied by a flat covered with cocoanut trees. In the middle of the entrance there is 36 feet of water; in the middle of the bay there is from 23 to 27 feet of water; the bottom is of mud and muddy sand, affording good anchorage. Everything tends to make it an excellent port, except its exposure to the winds from the north, northeast and northwest, which usually prevail, and sometimes with violence, in this part of the sea of the Antilles. The form of the coast, which tends to the northeast, affords the best protection to the west shore of the bay, which shore also has the greatest depth of water; these circumstances have induced me to make the termination of the canal or railroad on that shore of the bay, near the middle of its length, and a little inside of a small ravine called Cano de los Colorados. In order to make a good harbor at this point, a mole, placed at the extremity of a promontory which is within the ravine, will be required, to be extended into the bay 3,280 feet, where there is a depth of 29½ feet of water."—*Pages* 93, 94.

Termination on the Pacific.

"The coast of the Pacific ocean, on account of the great rise and fall of the tides, does not present as favorable a point for the crea-

tion of a harbor as the bay of Limon; there is one favorable circumstance, however, which is its situation in the bottom of the Gulf of Panama, which makes part of that zone of the great ocean which has assigned to it the name of *Pacific*, and which, by its position, re-entering within the land, insures a much greater tranquillity of its waters. This circumstance, joined to the vicinity of the Isles of Taboga and Taboguilla, situated only 7½ miles from the small bay of Vaca de Monte—[the proposed terminus]—islands where there is a good harbor and good anchorage for the largest vessels, would preclude the necessity, for a length of time at least, of the execution of any work intended for the protection of the termination against the rare and short tempests of those regions.

"The small bay of Vaca de Monte is nearly semi-circular, with an opening of 380 yards; by soundings made the 4th of July, 1844, [two days after the high tide of the full moon on the 30th of June,] 11½ feet of water at low tide was found in the middle of the entrance, 9 8 feet almost every place across the entrance, 8.8 feet in the middle of the entrance, and 11½ to 13 feet at a hundred yards from the shore. The tide of the 4th of July, being estimated at 15.74 feet in height, the foregoing heights would become, at half tide, 19 37 and 17.67 at the entrance, 16 60 in the bay, and 20.80 one hundred yards outside; a causeway extending 2,000 feet into the sea, would give an additional depth of water of at least 10 feet."—*Pages* 95, 96, 97.

Stone for construction.

"*Freestone.*—Of this there are as yet but two qualities known which have been and are still used at Panama and Chagres. At Panama, the quarries, situated 1¼ miles from the city on the road to Cruces, furnish porphyritic blocks from which beautiful stones can be very easily cut; they are employed in the buildings at Panama, and in the construction of the ramparts. At Chagres, freestone was originally used in building fort San Lorenzo, but it was impracticable to ascertain the location of the quarries, or from whence the stone was obtained; but from the similarity of its formation [a fine grained brown free stone] with that which forms the basis of the surrounding country, it is certain that they could be easily obtained and would furnish good cut stone. To these two kinds, we may add the limestone of Vamos-Vamos, which has a fine grain, and for hardness should be placed between the two preceding; these different kinds of stone are well situated for transportation, the first near the sea and port of Panama, and the others on the banks of the river Chagres.

"*Rough stone*, for ordinary masonry, can be obtained with great facility, and of extreme hardness, wherever it may be wanted throughout the extent of the isthmus.

"*Bricks.*—Clays of porphyritic formation make excellent bricks, and were used for them, and tiles, by the Spaniards when masters of the isthmus, and there is no doubt but that with good brick-makers

a most excellent article could be obtained with facility, and in any desired quantity.

"*Lime.*—At Chagres, they use as limestone the fossils of the sea polypites, which are found in great quantities at Limon bay, and in abundance at Porto Bello, where they employ them as cut stone, and where ancient columns of large dimensions may be seen formed from them; to which may be added the calcareous formations at Vamos-Vamos, and a limestone which is said to exist on the island of Taboga, in the Gulf of Panama. The lime made from these marine fossils, as also that from the shells picked up on the Pacific shores, is very greasy, and requires to be mixed with a certain quantity of argillous sandy material to make good hydraulic mortar; but independent of these resources, the island of Guadaloupe furnishes immense quantities of puzzolana, the transportation of which would not be expensive, and which, mixed with the oleaginous polypitic lime, makes a very good hydraulic cement.

"*Sand.*—There are no regular sand banks or beds throughout the isthmus, but the numerous rivulets deposite sufficiently large quantities on their banks, and the sand flats on both oceans afford an inexhaustible supply, particularly applicable to hydraulic works, and not much less so to works above the water in a country generally so humid," &c.—*Pages* 47 to 51.

Timber.

"The vast forests, which cover almost the entire soil of the isthmus, and which cease but to give place, in some points, to savannas or natural prairies, and occasional fields of maize, rice, bananas, and sugar cane, contain a very great variety of different kinds of wood; an intimate knowledge of their qualities is very much needed, and we must be satisfied with the mention of such as are in most common use.

"*Quipo* is the name given by the inhabitants to the tree, from the trunk of a single one of which the Indians make the boats in common use on the Chagres; it has a vertical trunk, perfectly straight and cylindrical, [its conicalness is less than that of the pine and fir trees,] slightly contracted at its foot, of a height which sometimes reaches 65 feet, and of a diameter of 9½ feet at the biggest part, about five feet above the ground; its trunk terminates abruptly at the top, as if cut off with an axe, and shoots forth a few horizontal branches something like those of the oak; the lower part of the trunk is perfectly united, without knots or branches, and at present is only used for building boats. The woods most frequently used for carpentry in building houses, are the *medlar*, [in Spanish '*nispero*,'] *mangrove* and *cedar*; but these names, which were given by the Spaniards to the trees of the countries discovered by them, have but a certain analogy, and not a perfect resemblance, to the trees of the same name in Europe. The '*nispero*,' generally employed for carpentry, is a hard, heavy wood, and has this advantage, for the isthmus, that it cannot be injured by the comehins, a small white worm which eats into almost every kind

of wood, and which it is sometimes difficult to be protected from; its hardness prevents its use except in carpentry, requiring neatness and care. This wood, the most valuable of all those known or used at present in the isthmus for the carpentry of houses, appears not to be of great use in the water, but it is probable that the qualities which give it great durability are not affected by laying it in the ground, because I have seen supplies of it on the banks of the great lake of Chiriqui, [Atlantic ocean,] intended for sleepers or cross ties of a projected railroad at Jamaica.

"The *mangrove* is also used for carpentry, but is considered much inferior to the 'nispero,' and is not used for any durable constructions.

"The *cedar*, although furnishing pieces of large sizes, is most generally used for planks in carpentry, but it is also used for the Indian canoes, particularly about the bay of San Blas, &c.

"*Mahogany* is also common for constructions on the isthmus; but it is very little like the mahogany from St. Domingo.

"*Gayac* is the name of a tree, the wood of which is so hard that the inhabitants leave it standing in their cleared grounds, and only use it for the toughest works, especially cylinders for sugar mills, &c.

"The *caoutchouc* is also very plentiful, but, unfortunately, up to the present time, has not been made of any use.

"Of all the trees mentioned, the '*quipo*' and '*cedar*' appear to be the most valuable for our purposes."—*Pages* 52 *to* 57.

General route of railroad—about 46 *miles long.*

"Starting from the bay of Vaca de Monte, on the Pacific, and running northwesterly until the valley of the Caimito is reached, up this valley, cross the Aguacata with a single arch, up the valley of the Bernadino, cross the dividing ridge at Ahagayagua point, by a tunnel 19,848 feet in length, the highest point of the road being 2,460 feet from the northern extremity of the tunnel, 196.85 feet above highest water at Panama, and 262.55 feet below the highest point of the dividing ridge between the two oceans, then down the valley of the Bonito, on its right bank, cross the Caño Quebrado about 2¼ miles above its entrance into the Chagres, down the valley of the left bank of the Chagres, cross the Trinidad about 2,000 feet above its mouth; descending the valley of the Chagres, cross it three times—first, at the village of La Bruja, from left to right; secondly, 2,850 feet lower down, from right to left; and thirdly, at Miraflores, from left to right—cross the Gatun on the right bank of the Chagres, about 500 feet above its confluence with that river; up the valley of the Gatun, until you clear some heavy spurs; then sweep round northerly to Limon bay; down its western shore to the point of termination, near the Caño de los Colorado. The three passages of the Chagres would each require a viaduct of 230 feet, that of the Trinidad of 148 feet, and that of the river Gatun one of 115 feet in length. All the other streams throughout the route are small, and can be readily crossed with single arches."

Estimate of cost—double track—one track through tunnel.

"For a tunnel 19 feet 8 inches wide, and 18 feet high, at $2 29 per cubic yard, equal to $90 04 per running yard.	
Length of tunnel, 6,616 yards, at $90 04	$595,704 64
Grading, largely estimated as averaging 16.40 feet, with a cross section of 760 square feet, at 23 cents per cubic yard—6,220,000 cubic yards, at 23 cents.	1,430,600 00
3 viaducts across the Chagres, each of 230 feet, at $40,000	120,000 00
1 viaduct across the Trinidad, of 148 feet	30,000 00
1 " " Gatun, of 115 feet	24,000 00
3 " of one arch each, across the Aguacata, Copé, and Caño Quebrado, from 40 to 50 feet in length, at $10,000 apiece	30,000 00
10 small bridges, at $3,000	30,000 00
Rails, [60 lbs. to the yard,] superstructure, cross-ties, spikes, &c., &c., &c., discharging crains, &c	1,575,280 00
Mole at Limon bay	1,013,600 00
" Vaca de Monte bay	865,000 00
Locomotives, wagons, cars, &c., &c	400,000 00
Storehouses, shops, stopping places, &c., &c	380,000 00
Entire cost of railroad	6,494,484 64

Estimate of the wages of workmen per man.

"Daily pay of laborer with shovel or pickaxe	$0 60
" " " as a miner	1 00
" " " " quarryman	1 00
" " a mason	1 00
" " a mortar carrier, &c	0 50
" " chief of wheelbarrow men, gang of	0 75
" " wheelbarrow man	0 50
" " a stone cutter	1 50
" " a carpenter	1 50
" " black, or white, smith	1 00

Means of execution.

"That part of the isthmus which belongs to Granada is thinly inhabited; but a sufficient number of laborers, such as diggers, and other low rank of workmen, could be obtained from that and the neighboring countries, who would have the advantage of being acclimated, and who, under careful task masters, or 'bosses,' would very soon become sufficiently expert in the use of the spade, shovel, pickaxe, &c., &c.; all the masons, carpenters, brickmakers, and other master workmen, would have to come from the United States, and could carry on their work during the rainy months, from June to November, under tents, sheds, &c., suitably located. To induce

this kind of necessary emigration, it might be advisable to give each of the better class of mechanics a certain quantity of land, taken from that which the Granadian government would readily grant to any responsible company executing the work; and thus the nucleus of a thriving, permanent population would be formed.

"The immense herds of cattle scattered through the isthmus, and now killed only for their hides, with the extraordinary fertility of the soil on the large savannas, meadows, &c., where, in eight months, magnificent fields of corn, rice, bananas, and sugar cane could be grown, puts the cheap feeding of the large body of men required for such an undertaking beyond a doubt; in addition to which, the contract with a former company [now declared null and void] gave free entry to all supplies; and the same privilege would, doubtless, be again granted to a company formed with the ability and determination to carry to completion this magnificent plan of intercommunication between the two oceans."—*Pages* 160, 1, 2.

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In the foregoing memoranda, I have freely extracted from the report of Mr. Chief Engineer Garella, all that usefully appertains to the construction of a railroad across the isthmus of Panama; and from his professional situation, from the circumstance that he was selected to make this survey by Monsieur Guizot, first minister of France, and from intrinsic evidences furnished by the report itself, there should not be a doubt but that the information contained in it is of the most reliable description, as far as it goes; but the prime, the cherished object of M. Garella, in making this survey, was the construction of an immense ship canal, with a depth of twenty-three feet of water, and costing, by his own estimates, $26,000,000. He, therefore, only gives the route and profile of the ground for this canal, from which I have been obliged to make the accompanying profile for a railroad, differing from his canal profile in distances, [being 2,478 yards shorter,] and not having any levels down the valley of the Chagres river, from Dos Hermanas to the Gatun river, a distance of 30,730 feet, for which distance his canal was to occupy the bed of the Chagres river, by, I presume, slack water navigation; but, taking the route as he has put it down, and this is by no means the most favorable point of view, it is placed beyond a doubt that a firm, substantial, and durable railroad, to answer all purposes of a safe and rapid intercommunication and transportation of the heaviest articles of commerce, can be constructed at a cost infinitely less than commensurate with its vast importance, and far within the estimate of M. Garella, which is $6,400,000 in round numbers. M. Garella's estimate of this work appears to me unnecessarily large in many particulars, especially when he puts down the amount of grading, [embankment, &c.,] as averaging 16.4 feet throughout the entire length of the road, excepting only the tunnel. In my opinion, his grades through the tunnel, and the first one north of the tunnel, [towards

Limon bay,] are much higher, with reference to the summit, than true economy, the description of the undertaking, and the nature of the work it is designed to accomplish, would appear to justify, requiring, as it does, a very heavy embankment for a long distance from the northern extremity of the tunnel, and a grade of fifty feet to the mile, [perfectly outrageous on such a work as this should be,] descending from the southern extremity of the tunnel, and crossing the river Copé, as shown by the red line on the accompanying profile, which is M. Garella's proposed trace of the railroad, and the highest point of which is 196.85 feet above the highest tides of the Pacific at Panama. At the summit of his grades, M. Garella has a level of 4,100 feet, viz: 1,640 feet from the mouth of the tunnel north, and 2,460 feet within the tunnel coming south. I am at a loss for any substantial reasons for this arrangement of grades, and consequently in the grade line which I have drawn through the tunnel, and to the north of it, designated by a blue line, I have preferred to throw the *apex* at or near the northern mouth of the tunnel, lowering it to 180 feet above the highest tides at Panama, or 16 85 feet lower than the apex of M. Garella's trace; thus throwing the whole length of the tunnel in favor of the short or Pacific side of the declivity, [from the Atlantic to the summit is about 3½ times as far as from the summit to the Pacific,] and have passed through the tunnel with a descending grade of 15 feet to the mile, and avoided M. Garella's heavy grade, [50 feet to the mile,] descending to and crossing the valley of the river Copé; from the north end of the tunnel, I have descended, with a grade of 20 feet to the mile, to the vicinity of the head-waters of the Caño Quebrado, and would thus save from ten to fifteen feet of embankment in height, for a distance of 11,000 yards, [from 6 to 800,000 cubic yards,] which would be required by following M. Garella's track. It is true that, by thus depressing the culminating point of the grade of the road, I shall have either somewhat increased the length of the tunnel, or the depth of the cutting at either extremity, but neither to an objectionable extent at all commensurate with the advantages gained, and far from equal in magnitude and difficulty, [if, indeed, there be any difficulty in either case,] to the tunnel located through the Alleghany ridge for the Chesapeake and Ohio canal; to the deep cuts on the canal from Arles in France, at Huehuetoca, near the city of Mexico, and even some portions of the Delaware and Raritan canal, &c., &c. In fact I feel convinced that a minute and careful examination of this route through the isthmus would render a still further depression of the grade proper and judicious, by which the heaviest grade on the line of road should not exceed 15 feet to the mile, or any radius of curvature be less than 4,000 feet. Going from the Chagres northward, M. Garella has adopted an ascending grade; this should be altered, and doubtless could be done with facility.

The termini of the proposed railroad in Limon bay, on the Atlantic, and Vaca de Monte bay, on the Pacific, ought not, I should judge, equal the estimate of M. Garella, even if the causeways in both instances were extended to ample depth of water, sufficiently

high to be perfectly safe, and wide enough for the erection of storehouses to receive goods from the ships' tackles.

A railroad across the isthmus of Panama is a truly beautiful, magnificent enterprise; its practicability and feasibility are no longer problematical, but established, fixed facts; and its advantages to commerce, to civilization, to humanity, are immeasurable; and I entertain no doubt whatever that a thorough, searching explanation and survey, which should be made between the months of November and May, would present such facilities for a judicious location as would utterly annihilate all doubts and prejudices, and afford proofs abundant and incontrovertible that a road, as perfect and durable as such a splendid undertaking demands, can be put in complete operation, at an average cost not greater than that of many railroads now in successful operation.

H. A. GOLDSBOROUGH, *C. E.*

August, 1848.

Note.—In the foregoing observations, I have forborne from making any estimates of the cost of this projected railroad, further than general remarks upon the estimates of M. Garella, which are confessedly large, and made, too, under strong prejudices in favor of a ship canal and against a railroad, which latter he regards as insufficient for, and incompatible with, the requirements of European commerce; an objection which, regarding the enterprise with reference to the United States, would readily disappear.

Such detailed and rigid estimates as the importance of this work imperatively demands, could only be made after a careful and detailed examination of the whole route, with the necessary instruments, by which alone the most judicious and available grades could be established; the correct cuttings and fillings every 100 feet or less made out; the most suitable terminations, locations, &c., of the tunnel, air shafts, &c., be marked, with the most economical distribution of the materials excavated therefrom; the exact lengths and elevations of the different viaducts ascertained; the proper lengths and dimensions of the termini on the Atlantic and Pacific be fixed upon, with the points from which the materials to construct these causeways could be most advantageously obtained; the various radii of curvature and alignments settled upon; the practicability of obtaining the necessary labor inquired into, &c., &c., &c.; without which data no satisfactory estimates ought to be attempted.

Such a survey as I have referred to could be thoroughly accomplished, by a properly organized party, during the approaching winter and spring months, for from 15,000 to 20,000 dollars.

H. A. G.

SURVEY OF THE ISTHMUS OF TEHUANTEPEC.

INTRODUCTION.

The project of a communication between the Atlantic and Pacific oceans, which has been the object of scientific investigation ever since the discovery of America, attracted also the attention of the Spanish government during the period that a great portion of that country formed an integral part of the monarchy. The cortes, having in view all that had been written upon this subject, and the various reports presented by persons charged with the surveys of the principal points suggested for the communication, and having taken into consideration the opinion of the regency of the kingdom, by a decree of the 30th April, 1814, authorized the opening of a canal across the isthmus of Tehuantepec, declaring that this enterprise should be carried into effect with the funds of the consulate of Guadalajara.

This election, which evinces the preference given by the Spanish government to the isthmus of Tehuantepec over those of Nicaragua and Panama, was overlooked in the various projects which have been set on foot since the independence; and what is still more strange, was also neglected by the government of Mexico, the most directly interested party, no doubt, from the distraction of political contests engrossing all other thoughts, and preventing the realization of every grand enterprise of this description.

In the year 1842, however, a government having been constituted with full and extraordinary powers, propositions were submitted to it by Don Joseph De Garay, for the opening of a communication over the isthmus. These propositions were declared to be accepted by a decree of the 1st of March of the same year; and, on the following day, an edict was published, proclaiming that on such communication being effected, the transit should be open to all nations, and the entire passage considered neutral territory. This decree concedes to Mr. Garay the exclusive privilege of executing the work; and, as a remuneration, grants him the establishment of the means of transport, with the right of tolls for fifty years, and the proprietorship of the waste lands, comprising a surface of upwards of thirty miles on either side of the line of communication. It further authorizes, with ample privileges, the settling of colonies within fifty leagues on both sides of the line, adding also in the same, as well as subsequent decrees, many other concessions of importance.

Mr. Garay, being bound to make surveys at his expense previously to the execution of the work, named the following scientific gentlemen commissioners for that purpose, viz:

Director.—Signor Gaetano Moro.
Engineer.—Lieutenant Colonel Dela Troupliniere.
Secretary and treasurer.—Don Pedro Garay, first officer of the ministry of war.
Assistant.—Don Mauro Guido, lieutenant of the navy.

This commission set out for Tehuantepec on the 30th April of the same year, amply provided with everything requisite; and its labors form the subject of the following memoir.

Report of the survey of the isthmus of Tehuantepec, executed in the years 1842, *and* 1843, *under the direction of the engineer, Signor Gaetano Moro.*

On accepting the direction of the scientific commission with which I have had the honor to be entrusted, one of the first points to which I directed my attention was the investigation of all the former data upon the subject. With the celebrated Hernando Cortez originated the idea of a communication by this isthmus between the two oceans. Its topographical advantages evidently did not escape the perspicacity of that extraordinary man, for it cannot be explained why, in the midst of a country so prodigously fertile, he should have chosen for his own domain the only portion of it comparatively unproductive, unless he clearly saw that any mode of communication to be hereafter carried into effect must necessarily be executed over this ground. Nevertheless, I am not of opinion that Cortez contemplated the opening of a canal, for, although it is observed in the work of Lorenzana that Cortez had studied mathematics, and that for more than a century the construction of locks had been practised in Italy, still their use was but of limited application, and on so small a scale that it is not probable they had much engaged the attention of Cortez. Further, to have ascertained the possibility of such a project could not have been effected otherwise than by carrying on operations which the vast engagements of Cortez would not have allowed him personally to superintend, and I much doubt whether any of his companions possessed the requisite knowledge for this undertaking; and, lastly, had he ever entertained such an idea, he would not have omitted to have made it known by asking the requisite grants and privileges from the emperor, in the same manner as he obtained the rights over all still and running waters (of little use for this purpose) within the territory of Las Marquesanas, as appears from the title deeds of these possessions, conceded to him in the isthmus. It appears to have been an object of intense interest with Cortez, to discover some strait which might naturally unite the two seas; for, in his fourth letter to Charles V., he informs him of having directed an expedition to proceed to Guatemala, because, he says, I have received information as well of the great riches of that country, as that in the opinion of many navigators there exists a

strait leading from that bay into the opposite sea, which is the thing above all others in this world I am desirous of meeting with, on account of the immense utility which I am convinced would result from it to the advantage of your imperial majesty. In the outset he was encouraged by brilliant expectations, and he announced that he had already directed several vessels to run along the bay of Ascension in search of the strait which it was supposed was to be there found. Cortez received daily information of the existence of new countries, (the Californias,) which no doubt appeared in vivid colors to the heated imaginations of these men, already so excited with the unexpected and prodigous discovery of a new world; nor is it to be wondered at, that with the imperfect notions then entertained of the configuration of the earth, Cortez himself should have been persuaded that these new regions which were announced to him, extended as far as Asia; for, speaking of the difficulties he met with in constructing four vessels in the South sea, he says: "I cannot describe how much I have at heart the possession of these ships, because I feel assured with them and the Divine pleasure, I shall be the cause of your majesty being in these regions lord of more kingdoms than are as yet known by our nation to have existence. And may it so please Him to appoint that your imperial majesty may obtain so great a blessing, because I firmly believe, that by what I have now ordered to be done, your highness will require nothing more to be the monarch of the world."

In the meanwhile the hopes of finding the strait were waning, and therefore the isthmus necessarily required greater and new importance in the eyes of Cortes. It was now, in my opinion, that he conceived the idea of a lucrative speculation, by means of a road over the isthmus, to supply Spain with the spices of the East Indies and the products of such new regions as he expected to discover. The following paragraphs of the above quoted letter, in which he expresses his wish to obtain a patent for this trade, and the artful manner he employs to attain it, appear to me clearly demonstrative of his object:

"In the preceding chapters I have informed you, O most puissant lord, of the countries to which I have despatched persons both by land and sea, by which means, under the guidance of Heaven, I believe your majesty will be greatly served; and as I am ever desirous, so am I continually intent, upon using every means to put into execution and carry out my wishes for the advancement of the service of your majesty. And seeing, on the other hand, that nothing more remained for this object than to discover the secrets of the coast still unexplored between the river Panuco and Florida, towards the north, as far as the Bacallaos—because it is asserted that in that coast there is a strait which passes into the South sea, and should this be found in accordance with the information I possess of the situation where the archipelago which Magellan discovered, by command of your highness, is to be found—it would then happen, should we, with the Divine assistance, so hit upon this strait, that the navigation from the spice countries (the East

Indies) to the kingdoms of your majesty would become excellent and shorter; so much so, that it would be two thirds less than the present navigation, and without any danger or risk to the ships in going and coming; because they would always make the passage through kingdoms and possessions of your majesty; and, in case of any emergency, they could repair damages without danger in whatsoever port they might make for that purpose, as being in your highness's own states. And thus, in the contemplation of the important service that could thereby accrue to your majesty, although personally hard pressed, and under heavy bonds for what I have expended, in all other armaments, as well by land as by sea, and in maintaining the stores and artillery which I have in this city, and which I despatch to every quarter, and the numerous other expenses and charges which every day occur, since everything has hitherto been done at my cost, and all articles which we have to provide are so dear and at such high prices, although this land be rich, yet it does not yield to me sufficient resources to meet the immense costs and charges that fall upon me. But, notwithstanding all this, bearing in mind what I have already said in this chapter, and setting aside for the present every difficulty that presses upon me—although I am constrained to inform your majesty that I am obliged to borrow money on this occasion—I have resolved to send three caravels and two brigantines for this object, which I calculate will cost me more than ten thousand pieces of gold, and thus add this one service more to all the others that I have rendered; because I esteem it above every other, if such a strait be found. Now, should this even prove otherwise, it is not possible but that many great and rich countries may be discovered, whereby the service of your majesty will be promoted, and the kingdoms and possessions of your royal crown vastly extended; therefore, some advantage may be gained, should such a strait not be found, in the knowledge your highness would obtain of its non-existence, when orders should be given so that your imperial majesty might avail yourself by another route of those spice countries and their neighboring states; and I hereby propose to your highness that, should it be your pleasure to cause them (the orders) to be issued and directed to me, I will undertake, in case no strait be found, to attain the object, to your majesty's advantage, at a less cost. Would to God that the expedition should succeed in its object, which is to discover a strait; because that would be most desirable, and which, I think, is very probable; because, with your majesty's usual good fortune, all difficulties vanish; and, for its success, I pledge myself to use every exertion, both heartily and willingly. In the same manner, I am about to send the ships which I have constructed in the South sea; and which, please God, will sail in the month of July, this year, 1524, to explore the lower coast in search of the said strait; because, should there be one, it cannot escape the observation of either of these in the South sea, or of the others going north; and as these who are going south will continue their exploration of the coast even as far as the land discovered by Magellan, whilst those to the north will pursue their

route as far as the Bacallaos, it cannot possibly be otherwise but one or the other of them should discover the secret. I assure your majesty that I am in possession of such information, in regard to the lands northward in the South sea, that it might have been very profitable to me, for the good of your majesty's service, to have sent these vessels in that direction; but as I have been made acquainted with your majesty's great desire to penetrate the secret of this strait, and the immense benefit it would be to your royal crown to discover one, I at once set aside all other considerations and interests of notorious importance to pursue this other route. May Heaven direct as may be most advantageous for the accomplishment of your majesty's wishes, and may I also be thus able to fulfil my desires to be of service."

It was in one of these expeditions that Newfoundland was discovered, from which Cortes derived his ducal title. After his return from Spain, in 1530, he resumed his researches for a passage. His efforts were unsuccessful; but, with the ships he had constructed in the South sea, he discovered in person the Californias.

Towards the end of the seventeenth century, Dampier, speaking of the Coatzacoalcos, said: "This is one of the principal rivers of this coast. It is not half the breadth of the Tobasco river, but deeper; its bar is less dangerous than any on this coast, there being fourteen feet of water and but little sea; within the bar, there is much greater depth, and a bed of soft oasie ground. * * * This river hath its rise near the South sea, and is navigable a great way into land, especially with boats or small craft."

The oldest among the documents of greatest importance which has next been obtained is the narrative of a voyage of discovery, which the engineer, Don Augustin Cramer, governor of the castle of San Juan de Ulloa, performed in 1774, by order of the viceroy, Don Antonio Maria Bucareli. His report, although so brief as scarcely to occupy one sheet of paper, is, nevertheless, a proof of sound judgment, and of the professional views of a man of great capacity. After his arrival at the isthmus, by the Gulf of Mexico, he commences with this important notice: "The bar of the river Coatzacoalcos has on it at half tide twenty-four palms of water, excepting a very small portion of its length, on which there are only eighteen palms. These soundings correspond with those taken on the first survey, and afterwards by me; for which reason, and as frequent soundings, taken by the present pilots during the last thirteen years, agree with them, it may be inferred that the said bar is permanently in the same state, or that if any variation occurs, it is so inconsiderable that it has escaped notice. After passing the bar, the river is from six to eight fathoms deep."

Cramer continues his narrative, briefly describing, but with admirable exactness, the course of the river up to Mal Paso, and demonstrates the facilities which the country presents for making a good road from this point to Tehuantepec, concluding with the remarkable observations which I here literally transcribe:

"The river course, with the mountain chain interrupted, between anta Mara Petapa and San Miguel Chimalapa, and the evenness

of the ground, plainly indicate that it would not be a work of great difficulty, nor excessively costly, to effect a communication between the two seas across this isthmus. In the supposition that the waters of the rivers Almoloya and Citune were held back, a canal might be opened to join them with those of the San Miguel or Chicapa, the course of which into the Pacific ocean, by the bar of San Francisco, passes by the Venta de Chicapa, and from this spot forwards there are no further difficulties; because it is one perfect plain as far as Tehuantepec." When we have given the topography of the isthmus, it will be immediately seen how rational was this project, bearing in mind its application to a canal of small dimensions, such as was contemplated by Cramer. It was with reference to these results that Baron de Humboldt, after having very properly asserted that until then "the topography of the isthmus of Tehuantepec was quite unknown in Europe," adds: "We cannot doubt that this point of the globe deserves no less attention than the Lake of Nicaragua." However, it is evident that, if the illustrious traveller ever saw any of the writings of Cramer upon the subject, it could not be the one I have just mentioned, for there is no allusion in it to the possibility alleged, by the baron, of a canal without locks, or without inclined plane.

In 1820, Robinson, speaking upon the same subject, writes: "We will now proceed to examine another, [route for a canal,] which, although it be deficient in some of the natural advantages of Costa Rica, still possesses others of so important a character, as to render it almost doubtful to us at which of the two places the desired communication ought first to be opened." And, speaking of the Coatzacoalcos, he adds: "It is the only port in the Mexican gulf where vessels of war, and others of a large size, can enter, and is far superior either to Pensacola or Espiritu Santo. There are at all seasons on the bar, at the mouth of that port, twenty-two feet water." When the Mexicans had established the independence of their country, their first natural desire was to promote the developments of the numerous elements of prosperity which their territory possesses, and which unfortunately remain in a great measure unprofited, even at the present day.

In the year 1824, the State of Vera Cruz and the federal governments appointed each a commission to survey the isthmus; the former chose Don Tadeo Ortiz, and the latter selected Colonel Don Juan de Orbegozo, of the general staff. But it was only after the return of our commission to Mexico that we could obtain the reports of Senor Ortiz. His attention was specially directed to the promotion of colonization and the cultivation of these fertile and favored districts of the republic, upon all of which topics he enlarges with much enthusiasm; but on what relates to our purpose he furnishes no light whatever; and his plans are not admissible, excepting only in so far as they propose to render the Coatzacoalcos navigable to the confluence of the Maletengo, and further, to construct a road from this point to the Pacific, passing through the Portillo de (gap of) Tarifa, the Venta de Chicapa, and the lagoons. He also observed the facility with which the Boca barra of San Fran-

cisco might be opened for the admission of large ships. In the sequel we shall advert to these observations, but limit ourselves at present to quoting those which refer to the bar of the Coatzacoalcos, and which are very important. "The bar of the Coatzacoalcos is permanent and constant, forming two canals or channels; that to the left, or the west, has on it, in the rainy season, (that is, from the beginning of June to the end of February,) 3½ fathoms of water, or 21 feet—these being increased to 23 at high tides; that on the right or to the east has 2½ fathoms, or 15 feet, and both during the dry season lessen three or four feet, the principal channel maintaining itself at no less than 18 feet, except, perhaps, under extraordinary circumstances. When a vessel would effect an entrance with a view only to greater security, the 15 feet channel should be preferred, because it has less current in it, and is probably wider, and because, when the sea breeze blows hard, the currents are rapid in the great channel, setting from east to west; and without taking a pilot it would be difficult, if not dangerous, to be entered by vessels of great draft of water. Since the direction of the channels is from north to south, we are of opinion that vessels can enter with the wind from north, northeast, and the easterly and southerly monsoons, by keeping to the wind. The prevailing winds offer no difficulty, with the same precaution, only attending to the currents, which, as before said, run with rapidity from the east to the west, and might cause vessels to be stranded. However, there are probably some periodical variations to the phenomena, which mariners would be the most competent to appreciate for their guidance. The departure of vessels by both channels cannot, of course, take place with the above winds, but easily with those from the south and west, and off the land, the latter of which almost every day prevails, at least during the rainy season, from after midnight till eight or nine in the morning, when the sea breezes commence; on which account vessels should proceed to sea after five o'clock, a. m., until seven, but not later than eight, which is allowing sufficient time for vessels to be beyond the danger of drifting into the dangerous iron-bound bay which is formed by the ridge of San Martin, running out to a promontory." It is evident that all these difficulties, described by Senor Ortiz for the entrance and exit of vessels, will completely disappear by stationing steamers at the mouth of the harbor.

The survey of Senor Orbegozo was made contemporaneously with that of Senor Ortiz; but he admits that he was in want of many things, and that on this account the results of his rapid examination must be defective, under the unfavorable circumstances in which he was placed; but as his narrative is printed, and the weight of his authority might be brought against us, we trust we shall be permitted to state the grounds for our trusting to our own observations, when they essentially differ with the results obtained by him.

The report of Senor Orbegozo commences, like that of Senor Cramer, with a description of the course of the Coatzacoalcos; and he states that it has 14 feet water upon its bar. But it is to be ob-

served that, possibly, he did not enter by the deepest channel, and it was in the month of May, and during an extraordinarily dry season. Senor Orbegozo found, as well as Senor Ortiz, that it would be both easy and advantageous to render the Coatzacoalcos navigable as far as the confluence with the Alaman, (or Malatengo;) and from this point he proposes a carriage road to be made as far as the lagoons, passing by the Chivela, instead of by the Portillo de Tarifa, as proposed by Ortiz. From a pier to be constructed on the edge of the upper lagoon, Senor Orbegozo says that goods might be shipped upon flat-boats, to continue the communication, as far as San Dionisio. "Possibly," he says, "it might not be very expensive to excavate a haven on the opposite side of the bar of Santa Teresa for vessels drawing 20 and more feet of water, and also deepen the principal bar;" and he concludes, saying: "Lastly, if the small harbor which exists near the mouth of the river Tehuantepec was found to be better adapted for the anchoring of large vessels, then it would be easy to make an opening from the upper lagoon at Tilema, (the western side of the lower lagoon,) across the sandy tongue of land which divides them, and from Tilema construct a short canal to the mouth of the Tehuantepec, to the south of the hills of Huilotepec." As to the construction of a canal, he did not merely leave it problematical, but it appeared to him so beset with difficulties as to render it almost impracticable; which certainly would be the case if it rested upon the assumption, as he viewed it, of only making use of the waters of the Coatzacoalcos, taken from the eastward of Santa Maria Chimalapa, to be conducted to San Miguel and joined with the Chicapa.

I must not conclude this enumeration of the data which have been collected relative to the topography of the isthmus of Tehuantepec, without quoting the opinion of the first geographer of our times, the judicious Balbi, who considers the Coatzacoalcos "as the finest port of all the rivers which discharge themselves into the Gulf of Mexico, not even excepting the Mississippi itself."

Proceedings of the Commission at the Isthmus.

We arrived at Tehuantepec on the 28th of May, and proceeded immediately to examine the state of the instruments which were to be used. These consisted chiefly of—

1. A theodolite, beautifully constructed by Mr. W. Cary, of London, but with only one telescope, and of small size, its diameter being only 0.127 metres.
2. A sextant, of Gambey, of 0.20 in radius.
3. Two ditto, of Chevalier, of 0.15 in ditto.
4. Another, of Cary's, of 0.13 in ditto.
5. A good level, with telescope, of unknown make.
6. Two barometers, (á cuvette,) by Cary.
7. Two pocket chronometers—one by Roskel, (No. 171,) and the other by French.

Our journey from Mexico had occupied nearly a month, and the

roads were so bad that almost all the instruments had been, more or less, injured. The vertical axis of the theodolite was bent, although, fortunately, in a very slight degree, and one of the sextants of Chevalier was found to be quite useless. We had taken the precaution to employ a man travelling on foot to carry the chronometer and barometers, but the latter had been filled in Mexico with little care, and it was soon perceived that they contained a considerable quantity of air. We proceeded immediately to remedy these accidents, in so far as it was possible, and particularly to refill the barometers. A sufficient quantity of purified quicksilver had been brought from Mexico, but the filling of the tubes proved to be a work of some difficulty and exceedingly irksome, from the total want of convenient means, and from having to withstand both the intense artificial heat required for this operation, and that of a naturally burning atmosphere. I succeeded, however, in accomplishing the object, with the aid Captain Gonzalez, in a manner which left no room to doubt the accuracy of any operations performed by means of these instruments. The preliminary arrangements occupied us until the 2d of June. It would naturally apppear that, to proceed with accuracy, the country ought to have been explored previous to undertaking any geodesical operations. We were, however, from peculiar circumstances, induced to act otherwise. The possibility of effecting a communication between the two oceans, through the isthmus, may be considered under four different aspects.

1. By a road.
2. By a tranship canal.
3. By these two means combined.
4. By a canal of great dimensions, which would afford a transit to the loaded vessels themselves from sea to sea. It is natural to suppose that this plan, being by far the most advantageous, was that to which our attention was chiefly directed. All accounts agree in the facility with which the river Coatzacoalcos might be rendered navigable, at least so far as its confluence with the Sarabia; therefore, the space which it was most important for us to explore was that intervening between the confluence and the shores of the Pacific. The rains appeared to have set in on the mountains, (Sierra,) which prevented the possibility of exploring them; and, as our time was limited, I resolved to take advantage of it by commencing proceedings on the southern side of the isthmus. With this view we made a rapid excursion on the coast, during which I observed latterly and towards the north of the ground that divides the villages of San Mateo and Santa Maria, a tract of land which appeared to me well calculated for the measurement of a line to be used as the basis of our trigonometrical operations; and, consequently, the exploring party established their residence at San Mateo. Messrs. Ortiz and Orbegozo had discontinued the soundings of the lakes and the Boca barra (bar entrance) of San Francisco, because they could not find a boat for the purpose. This want was at once provided for by adapting a sail, oars, and helm, to a common canoe. Meanwhile, I had directed some landmarks

to be erected in those places which appeared to me the most fit as vertexes of the first triangles of our trigonometrical net.

These landmarks usually consisted of three poles, so placed as to represent the skeleton of two pyramids, one of them resting inverted on the other. The smaller of the two, namely, the uppermost, was filled out that it might appear conspicuous to the eye, and the observations were directed to the common vertex of both pyramids; from this point was suspended a plummet, by means of which the instrument could be made to correspond vertically with the landmark, whilst any deviation in the perpendicular position of the latter could at once be detected by a stake which was driven into the ground precisely under the plummet. The base line, which I had at first selected, had its two extremities in two hillocks, from whence the greater part of those points which I first wished to determine could be perfectly seen; but the intervening ground presented a degree of unevenness that made me fear I should not be able to measure it with sufficient accuracy, considering the insufficiency of the means we possessed for the purpose. This circumstance induced me to fix another line on the beach, which happening to be remarkably level, was admirably adapted to the purpose. The new line was subsequently connected with the two original points best calculated for our observations. The only means we possessed of measuring the base were two steel chains, (a decametre each in length,) one constructed by Mr. W. Cary, of London, and the other by Mr. Yecker, of Paris. We had, likewise, two levelling staves, of Chevalier, of two metres each, by means of which we measured, as accurately as possible, a straight distance of ten metres, which measurement was noted down on the floor of the parsonage house at St. Matea, in order to use it afterwards as a means of comparison for the purpose of testing the alterations in the chains during the subsequent operation. Our precautions for the measurement of the base were chiefly limited to what has just been stated; it would have been difficult to make them more extensive; and those acquainted with these matters will at once perceive that it would have been useless to attempt carrying them any further, since the instruments we had for the purpose of measuring angles enabled us only to do it within half a minute of their true value. The tracing of the base was an operation attended with immense difficulty. The rainy season had commenced, and frequently impeded the prosecution of our labors.

An almost incessant wind either blew down or inclined obliquely our landmarks, or causing the instruments to oscillate violently, disturbed our observations; and, lastly, with the exception of a few moments before the rising of the sun and after its setting, a dense flickering vapor hid from view the objects which served us as guides, whilst the refractions, especially the lateral ones, produced the most strange illusions. In measuring the base I used to proceed first with Yecker's chain, Messrs. La Trouplinière and Gonzalez following me with Cary's. On arriving at certain given spots, I calculated, by the difference found in the length of the two chains, the distance which my colleagues ought to find, and I

had often the satisfaction to see that both measurements were identical. When the differences (which never exceeded three decimetres in a thousand metres) appeared to me too great, the operation was repeated; and thus it occurred occasionally that the same distance was measured in this manner four consecutive times. The Zapoteco soldiers, who carried the chain, evinced a wonderful degree of intelligence, and in a very short time they became as proficient as could be wished. After the necessary corrections to the mean sums of the separate measurements, the total length of the base was obtained, showing an aggregate distance of 16,930 metres.

During our residence in San Mateo we made a great number of meteorological observations, besides measuring a considerable series of angles for the purpose of establishing the position of various points. As to astronomical observations, their number was unavoidably limited in consequence of the greater part of the nights being cloudy, and also from the high winds, which made the use of artificial horizons, and consequently that of the reflective instruments, extremely difficult. Every attempt to determine the longitude of that place proved vain, and I could only ascertain its latitude. Mr. Theodore De La Troupliniére ceased to be a member of the commission at the beginning of August; dividing the work, therefore, with Captain Gonzalez, we proceeded to raise the plan of the peninsula wherein are situated the villages of St. Mateo and Santa Maria, referring to the points trigonometrically fixed; the same was afterwards done with the coast of the Pacific as far as the Morro, and the tract of country between the sea and the town of Tehuantepec, including the course of the river by which it is watered, and which flows afterward into the haven of Las Ventosas. It had been suggested that this bay might be used for the purpose of anchorage, but on examination I found that its small size, as well as its exposure to the prevailing winds, made it totally unfit for such purpose, even supposing that it were deep enough. The other haven to the west of Morro is also too much exposed, and filled with dangerous reefs; and though it be true that Cortes launched a few vessels in the first of these coves, it is well known that in those times vessels were built of small dimensions, and probably he made use of that spot, not because he considered it fit and safe for such an operation, but simply because it was the only one near at hand where it could be at all accomplished. The sands carried down by the waters of the Tehuantepec are now fast accumulating in the bay, and before long it will be completely obstructed. Towards the end of August we returned to Tehuantepec, where the secretary of the commission was stationed, and there we had the pleasure of obtaining an able assistant in the person of the captain of engineers, Don Manuel Robles, professor of astronomy and geodæssia of the military college of Mexico. This gentleman brought with him several excellent instruments, the principal of which were—

1. A circle of Bordas, of 0.35 metres of diameter, constructed by Gambey.

2. A reflecting circle, of 0.20 metres, constructed by Mr. W. Cary.
3. A French theodolite, of small dimensions.
4. A telescope, of Dolland.
5. Two empty barometers, (á cuvette,) of Cary's.
6. A chronometer, of Roskel, No. 301.
7. A level, with telescope.

Had we possessed instruments like these from the commencement, the operations would have been undertaken in a very different manner; and we even had the idea of performing them over again, but it would have been necessary to use other means for measuring the base; and considering that time became every day more valuable, and that, after all, our labors might offer the required usefulness without going beyond the limits of a good exploration, it was resolved to go on in the same manner as before, rectifying, however, the results by means of observations made with the more delicate instruments. The commission then proceeded to San Dionisio Tepehuazontlan, having been joined by Don Mauro Guido, who, having left the secretaryship, usefully assisted to the last in the labors of the commission. As for myself, I carried on my observations in Camotepec and Juchitan, and proceeded to reconnoitre new points, in order to extend our triangulations. My object being accomplished, I sailed from the quay of Salina, near the Estacada, in the canoe fitted out as before mentioned, and passing between the islands of Monapos-tiac and Natartiac, I arrived at San Dionisio, the sounding line constantly showing nearly six metres depth of water, the bottom being mud and shingle, both easy to remove. The natives of San Dionisio distinguish the lakes or lagoons in the neighborhood of their villages with very appropriate names. They call the more northern lake Duic-quialoi, which means upper sea, and Duic-quialiat (lower sea) the southern. This latter lake they divide into two, by means of an imaginary line from the canal of Santa Teresa to the Boca barra, giving the names of Duic-namulet and Duic-nahuanot (western and eastern seas) to the supposed division. The Pacific they call Nadam-duic (great sea.) I shall employ these equivalent names in alluding to the above mentioned lagoons. It was supposed before our exploration that the lower lake extended as far as the bar of Tonala, (some sixty quilometres to the east of Boca barra,) leaving between the lake itself and the Pacific a narrow strip of land, designated by the name of the island of St. Francisco; it was believed, also, that the whole of the lake was nothing else but a creek of little depth, and no importance, as is the western part, known likewise by the names of lagoon of Tilema and Dead Sea. However, on ascending the hill of Umalalang, which overlooks the village of St. Dionisio, this erroneous impression was soon dispelled by observing that the ground to the east of Boca barra extends itself considerably, and contains other lakes of some extent. This induced me to explore it at once. On proceeding thither, the eastern part of the lower lagoon attracted my attention, as I could not but observe that its vicinity to the Boca barra and the canal

of Santa Teresa, its considerable depth and excellent bed, and the circumstance of being so well sheltered from the prevailing winds, fitted it admirably for a commodious and safe anchorage. Whilst Captain Robles was raising the plan of a portion of this lake, I proceeded with Lieutenant Guido to explore the Boca barra; the tide which was beginning to ebb, produced a current that did not allow us to steer our imperfect craft, and was carrying us towards the sea with such force, that we clearly saw by the effort necessary to keep our position that it would be impossible to surmount its impetus, so as to effect our return, should we be carried out. The tide was too strong to use the sounding line; but it was evident that a sand bank obstructs internally the Boca barra throughout its whole length from east to west, and it appeared to me important to investigate the cause which might have produced it. The idea that a canal of great dimensions was the only advantageous means of effecting the desired communication, induced me from the moment of my arrival in the isthmus to use every endeavor to ascertain the course and volume of waters of the several rivers, without being deterred by their distance from the localities pointed out hitherto as the most favorable for the purpose. Amongst them all I directed my most particular attention to the river Ostuta, remarkable for tne volume and regular course of its waters, which were said to flow into the Pacific by the bar of Tonalá. The origin of this river is unknown, and has never been examined, from the popular belief that it proceeds from a spot so rugged among the mountains as to be almost inaccessible. The general opinion, founded on vague traditions, is, that it takes its source from a large lake, situated somewhere in the mountains, supposed also to have lent their waters to the river Coatzacoalcas and Chicapa, with the romantic addition that the said lake is under the dominion of a fair lady, who appears to those who have the hardihood to visit its shores. This popular opinion arises from having observed that these three rivers increase in volume when the northern winds blow, and then decrease simultaneously, whilst their waters are constantly clear and limpid, the natives attributing these natural and simple phenomena to an improbable overflow of the waters of the lake when agitated by these winds.

In the course of our operations, we were greatly surprised to find that the river Ostuta does not discharge itself into the ocean by the bar of Tonalá, as we have been led to suppose; but that, after having formed the lagoons situated in the neighborhood of St. Francisco, it flows through the barillo, and the mouth of Lagartero, in the Duic-nahuanot. It may be well to observe that, although the waters of the Chicapa and of the Ostuta are always limpid, this is only to be understood of the upper part of their course; for in the plain, during the rainy season, they often gather the sands of the alluvious soil through which they flow. On entering the eastern lower lagoon, the currents of the Ostuta flow along the southern shore, and decreasing gradually in their impetus, they reach the Boca barra so powerless as to deposite there the sands they bring with them. These are afterwards shaped

into a large sand-bank by the waves, kept in incessant agitation by the northerly wind which prevails almost constantly in those regions. In the plans which will be proposed, it is intended to make use of the waters of the Ostuta, taken from the Sierra, in order to feed the canal; by doing which, the principal cause of the formation of this bank would be removed. But as it would not be possible to prevent the waters that join the Ostuta in the plain from flowing in the same channel, and as this river did formerly flow into the lake of Tonalá, it would be advisable to shape again its course in the primitive direction, an operation which offers no difficulty whatever. The sand-bank of the Boca barra, however, may, I think, be attributed to another and more powerful cause. The river Tehuantepec flowed, not many years ago, into the western lower lagoon, as may be seen by the map of the southern division of the isthmus. The opposing currents of both rivers destroyed reciprocally their strength, and caused the deposite in that particular spot of the matter they bring with them. Fortunately, the river Tehuantepec spontaneously abandoned this direction, and care should be taken to preserve it in the course which it is now adopted.

It appeared to General Orbegozo, that the sand-bank of which we have spoken, was produced by the rivers Chicopa and Juchitan; but I cannot coincide in this opinion. There is no doubt that during the rainy season, these two rivers are loaded with sands; especially the latter, which traverses a large tract of movable earth, as is shown by the respective size of the alluvial deposites which these rivers have formed at the entrance of the upper lagoon. But to me it is also evident that they cannot do less than deposite these sands in the lagoons which they have to cross in their progress towards the Boca barra; before reaching which they have therefore freed themselves of most of their sands. Were it not so, they would deposite them, as is always the case, on the outside of the Boca barra, forming a true bar, quite different from the sand-bank now under consideration. However, should it be ascertained that the two rivers contribute to its formation, it will be seen that the Chicapa is one, the course of which will be directed to supply water to the canal; and as regards the Juchitan, it would not be difficult to change its course, or compel it to discharge its superfluous matter in a convenient part of the lower lake previous to its flowing into the sea.

These obstacles once removed, it would be neither difficult nor expensive to render practicable the Boca barra, with the certainty that the sand-bank, which offered so great an obstacle to the projected communication, would never be formed again.

Taking advantage of a calm between two tides, Messrs. Robles and Guido succeeded in going out to sea through the Boca barra, and executing the soundings indicated in the plans. They found that immediately after passing the bank, there was a canal, the depth of which, even in the the shallowest part, is of nearly six metres, this depth increasing afterwards rapidly.

At present, the tract of land to the east of Boca barra cannot

with propriety be called an island, since it is only temporarily during the rainy season that its lakes communicate with the lake of Tonalá, by means of some marshes, through which the natives can only with great difficulty drag their insignificant canoes.

The exploring party concluded operations in this part of the isthmus, and returned shortly afterwards to San Dionisio, notwithstanding the bad weather and various accidents which greatly impeded their labors.

We remained at Dionisio the required space of time to collect and arrange the necessary data for raising the plan of the lakes, and of a part of the land between them and the river Ostuta.

The weather continued unfavorable, particularly for astronomical observations, and various attempts made to determine the longitude of San Dionisio were frustrated, although its latitude was ascertained. No opportunity was neglected to collect copious series of barometrical observations.

The party assembled at Juchitan towards the end of October. This spot, proving to be the centre of several trigonometrical operations, had been selected for the purpose of referring to it the position of all the other points, after having previously ascertained its exact latitude and longitude.

The projector, Don José de Garay, expressed from Mexico his earnest wish that the exploration of the river Coatzacoalcos should be immediately proceeded with, and upon the termination of the labors at San Dionisio, it was considered that the season was sufficiently advanced to comply with this request.

When I left for Coatzacoalcos, accompanied by the secretary Don Pedro Garay, and Don Mauro Guido, the exploring party were divided into two sections, one of which was entrusted to Captain Robles, in whose abilities complete reliance could be placed. This gentleman undertook also the superintendence of the observations necessary to determine astronomically the position of Juchitan, as soon as a favorable opportunity should offer, and I requested him to extend the trigonometrical operations as far as the foot of the mountains, and especially to explore the upper part of the river Ostuta, which had before attracted so much of my attention. This section of the party established themselves in the Venta de Chicapa, which from that moment became the meeting point of the commission until the close of their labors in the isthmus.

As regards ourselves, we arrived at the Mal Paso, after having passed through Chivela, Guichicovi, and Boca de Monte. Guichicovi is situated at the commencement of the rugged part of the Sierra; and the gentle hills in the neighborhood of Chivela, approaching this spot, are, at intervals, interrupted by precipitous ravines, through which several rivers and streams find a passage for their waters. The surface of the ground becomes more level receding from Guichicovi towards Boca de Monte, from whence, as far as the Mal Paso, it finally becomes a perfect plain, occupied by a forest of useful and precious timber.

On arriving at Mal Paso, I was surprised at the view presented by the Coatzacoalcos, which, from the transparency and slow pro-

gress of its waters, had more the appearance of an artificial canal than that of a mighty river. Its banks of strong clay are firm and easy of access, with an almost uniform elevation of a few metres, which leads to the supposition that the river runs along a level surface, although the thick woods that line its shores conceal from view the topographical aspect of the land covered by them.

Our excursion along the river scarcely deserves the name of an exploration, especially as the weather was so unfavorable as not to allow us to make any kind of observation. Neither was it possible to take soundings of the bar on this occasion; but we learned, however, that only a few years ago a French vessel of five metres and a half of draught entered it; and from the battery situated at the left entrance, its principal channel appeared to be more gentle and clear than any other with which I am acquainted. It is well known that bars owe their formation to the materials conveyed by rivers; hence the unobstructed regularity of the bar of the Coatzacoalcos is simply accounted for by the clearness and limpidity of its waters.

A short exploring expedition was made from the Fabrica, or Mina-titlan, to Acayucam. The season did not permit of our undertaking any operations to trace the course of the river, and on our return to Mina-titlan we again ascended the Coatzacoalcos, as far as its confluence with the Jumuapa, which we also ascended as far as the Paso de la Puerta, and from this place took the direction of Chivela, passing by Guichicovi.

From Chivela, we proceeded towards Tarifa, along a table-land covered with a great number of gentle and interrupted declivities, and along a road so level, that it inspired me with the most flattering hopes. From Tarifa, the ground continues to be still more favorable as far as the Portillo or gap, from which a rapid descent leads to the plain, in which is situated the Venta de Chicapa. Our tour had lasted a month, during which Messrs. Robles and Gonzalez had actively continued their operations, not only in the lower part of the country, but also in that which extends from the village of San Miguel to the hills of Petapa. Captain Robles had likewise examined the ground from San Miguel to the river del Corte, in the neighborhood of Santa Maria Chimalapa.

The reports which awaited me were not very favorable. The exploration of the river Ostuta had been abandoned, because it was supposed to proceed from too eastern a direction to be available; and it appeared that the only river still deserving our attention was the Coatzacoalcos, although the exploration of General Orbegozo seemed to show that any attempt to make its waters available would meet with almost insurmountable difficulties.

These accounts, however, were not sufficiently positive to cause me to be dismayed; and, meanwhile, I resolved to reconnoitre the points which had been fixed during my absence. On arriving at one of these, on the summit of a hill about 1,600 metres to the north of the village of San Miguel, which afterwards received, in

commemoration, the name of Cerro de Albricias, (Reward Hill,) I saw the problem at once solved.

The Sierra Madre (or principal chain of the Andes) appears to be interrupted, as the engineer, Cramer, judiciously observed, between Santa Maria Petapa and San Miguel Chimalapa. On the western side it descends rapidly as far as the first of these villages, and proceeds again suddenly towards the east of the second, leaving in the middle a surface comparatively level. To the south the small chain of Masahua and Espinosa, of moderate elevation, forms a barrier between this hilly tract of ground and the true plain, terminating at their extremities in two openings or gaps through the western, most of which descends the road from Chivela, leading to the plain, and another through the eastern, from Tarifa to the Venta de Chicapa. On the north the table-land extends itself, gently descending as far as the Coatzacoalcos, and from thence to the Atlantic.

The river Chicapa reaches San Miguel, occupying, in its course from east to west, the bottom of a straight dale between two uninterrupted chains of mountains, and then suddenly proceeds in a north to south direction towards the plain, wherein is the upper lagoon which receives its waters.

Running in a line diametrically opposite to the first course of the Chicapa, viz: from west to east, the stream of Monetza joins the above river, near San Miguel, by another dale which, in reality, is only the continuation of the first, and would lead directly to Tarifa, were it not divided from the plain on which this estate lies by a small chain, of which the Cerro del Convento forms a part.

The village of San Miguel is situated in a small valley lower than the plain of Tarifa, by more than 80 metres; but as the most northern of the two chains, between which the rivers Chicapa and Monetza are enclosed, has no interruption whatever, I thought it possible to convey along its side the waters of the first of those two rivers as far as Tarifa, from whence they might be distributed to both seas; neither did I consider it difficult to surmount the natural barrier formed by the small chain of Convento between the valley of the Monetza and the table-land of Tarifa. The hill of Convento rises almost isolated, and the gaps on both sides, especially the northern, is of so trifling an elevation above the ground, that a cut through the latter would be an almost insignificant undertaking.

This discovery induced me at once to give up the idea of returning to the Coatzacoalcos, with the view of raising the plan of its course, as I had first resolved; and I entrusted this operation to Messrs. Robles and Gonzalez, who immediately proceeded thither for the purpose.

Meanwhile, I directed that Lieutenant Guido should station himself at Tarifa with a barometer, whilst I, following the dale of Chicapa, arrived with another barometer to the place called the Ultimo Rancho, where I thought the elevation of the river might be equivalent to that of the plain of Tarifa.

Two series of barometrical observations performed simultane-

ously in two successive days, and under the most favorable atmospherical circumstances, showed that these two points are on the same level; whilst about two quilometres higher up from the spot in which I stationed myself, the river forms a cascade of nearly seven metres high.

From San Miguel to the Ultimo Rancho, five constant streams join the Chicapa; and, having measured the waters of this river in a point below its junction with these streams, I find them equivalent to more than five metres per second, so that by adding to it the Monetza and the stream which runs through San Miguel, called Xoxocuta, a body of water of about seven cubic metres may be reckoned upon. According to all the information collected, these waters were then in a state which might be considered the minimum of their quantity, and they are always exceedingly clear and pure.

This satisfactory result induced me to undertake, without loss of time, the inspection of the hill of Convento, in order to judge of the magnitude of the difficulties that might offer in that quarter. The dreaded obstacle has been, in a great measure, removed by nature.

In that part where the hill of Convento is most depressed, namely, the northern side, the river Monetza takes its source, and, following along a dale in the centre of the hill itself, penetrates under it, and, crossing it entirely, comes out in the small valley through which it runs to San Miguel. The point of the opening in which the river has its origin is entirely hollow, since the gush of water which forms it issues from the walls of a cave or fissure about seven metres high, and the thickness of its vault is, perhaps, another metre. Besides, the situation of the hill and the rock of which it is composed, which, being of pure marble, is admirably calculated to procure beautiful building materials, as well as excellent lime to cement them, are all inviting circumstances to convert it into a quarry; thus, even were it considered necessary to make a cut in this part of the hill, the work would be accomplished whilst opening the quarry to procure the necessary materials. The river Monetza, in running under the Cerro del Convento, has only to cross a distance of about a hundred metres, although it passes through the very centre, and, consequently, the thickest part of the mountain.

Another barometrical level, obtained from observations performed simultaneously at Tarifa and at the source of the Monetza, showed that the level of this river is nearly the same as the stream adjoining Tarifa, the waters of which run to the Coatzacoalcos. The ground that lies between Tarifa and the source of the Monetza is not only level, but is even interrupted by torrent streams, the waters of which flow into the Monetza; and, as these streams have their origin at a short distance from Tarifa, this ought to be considered as the proper spot for the division of waters in the canal.

The houses of Tarifa are somewhat elevated in the midst of a ground so level that, in the rainy season, it becomes inundated,

for which reason this plain has been called the lake of Tarifa. I took advantage of this circumstance to save the trouble of a new levelling from the latter place and the Portillo, or opening of the road to Venta, since the line left by the waters on subsiding clearly shows that the two points are nearly on a level; thus, with a cut a few decimetres deep in the edge of the Portillo, the waters to the south of Tarifa would proceed towards the Pacific, whilst those on the northern side naturally run towards the other sea.

To complete my wishes, I only wanted now to find the manner of increasing the volume of available waters, and to avoid having recourse to the expensive means of constructing great deposites; and recollecting that, on my journey from Chivela to Guichicovi, the situation of the source of the Almoloya had been pointed out to me from afar, I did not think it possible to take advantage of the waters of this river.

By means of a series of barometrical observations made at the same time at Tarifa and Chivela, I previously found that the first of these estates is less elevated than the second, contrary to that which was formerly believed. Employing the same means, the Chivela proved to be fifteen metres lower than the source of the Almoloya, a difference which might be increased by damming up the sources of the river. I have measured its waters, doing afterwards the same with those of the streams of St. Domingo, Citune, and others of less note, and I accordingly calculate that, by joining them all, a volume of waters of more than two cubic metres might be conveyed to Tarifa at the least favorable season of the year, and another considerably greater during the remainder. These waters have also the great advantage of being always clear, but their distance from Tarifa, and the difficulties of the ground they would have to cross, would make their conveyance somewhat expensive; and, therefore, I thought that something else remained for me to do, and I resolved to examine the mighty river of Ostuta.

I returned to the venta, from whence I proceeded to Zanatepec for the purpose of finding some natives who might act as guides. I experienced some difficulty in fording the river, which was rather swollen, notwithstanding which, its waters continued to be perfectly clear as far as that spot. On reaching Zanatepec, I examined the documents deposited in the archives of the village, amongst which I found a few fragments of a plan of the land comprised in its jurisdiction. This interesting document, almost entirely destroyed, may be inferred to have been executed during the first period of the conquest; for whilst it is painted on paper made of *Maguey*, (agave Americana,) and preserves all the characteristic signs of the Aztec works of this kind, there is on it a figure of a Spaniard, by whose order the plan was probably raised; but that which most particularly attracted my attention, was to find noted down the traditional opinion that the river Ostuta takes its source in a lake.

It was with the greatest difficulty that I found any one able to accompany me in the exploration of the river. Amongst the inha-

bitants of the town, there were only two old men who remembered having visited a small portion of its course, and pictured with the blackest colors the dangers and difficulties of the undertaking. It would be tedious to enumerate those which existed in reality; suffice it to say, that after several vain attempts, I succeeded, by following up the banks of the river, in reaching the foot of the high hills from whence it proceeds. Throughout the whole distance the river receives no constant tributary, and its waters increase as they approach their source, which shows that a portion of them becomes absorbed in the lower part of the course of the river.

I have not measured the waters of the Ostuta, not only on account of the difficulty of doing so, but because they often vary in an extraordinary manner; but I believe I may venture to assert that they are never less than three times as copious as those of the Chicapa, and frequently more than six.

The wild state of the country compelled us to cut our way through the woods when we could not take advantage of the pathways or tracks formed by the numerous tapirs which inhabit those regions. For this reason, and also on account of the rugged hills between which the river is imbedded, it was impossible to discover the adjacent grounds; but the direction in which we had constantly proceeded, namely, towards the north and inclining afterwards to the west, as well as the distance we had gone, made me suppose that we were near the upper course of the Chicapa. I was not mistaken, for I perceived suddenly at a short distance to the west the Cerro Atravesado, an eminence which I had reconnoitred before to its very summit, after the first fruitless exploration of the river Ostuta.

The elevated situation in which we were, and the proximity of the two rivers, seemed to promise that there would be no great difficulty in effecting their junction; but the intervening woods, by concealing from view the topographical aspect of the ground, did not permit a fair estimate being formed of the difficulties there might be to encounter.

The river came down precipitously from the mountains, and for a considerable distance had ceased to be fordable. It was every moment more and more difficult to ascend its course along the same bank, and at last it became evident that, in order to estimate correctly the obstacles which might oppose themselves to the projected junction, nothing else remained but to reach, if possible, the very spot where we then were, by descending along the craggy side of the Cerro Atravesado which lay opposite.

Meanwhile it appeared evident to me that both the Chicapa and the Ostuta proceed from that portion of these territories where the Sierra Madre is highest, which explains why these rivers increase and diminish simultaneously, without its being at all necessary to suppose that they owe their origin to a lake. The attraction which mountains exercise upon the clouds is well known. The clouds which proceed from the Atlantic, or which are formed on the immense plain watered by the river Coatzacoalcos, as well as by a great number of other rivers, streams, and lakes, whenever the

wind blows from the north, are wafted precisely in the direction of this elevated portion of the Sierra which they have to traverse, and which compels them to discharge their contents on its summit, from whence they descend transformed into streams and rivers; nor is it less evident that when other winds prevail, as the same causes do not exist, so the corresponding effects naturally cease.

On my return from my expedition I went to Niltepec, for the purpose of ascending the Atravesado. The bad weather overtook me on its summit during the night, and the following day, finding it impossible to withstand its inclemency without a shelter, I was about to abandon the undertaking, when an interval of hope encouraged me to persist, and the weather, becoming more genial, rewarded my perseverance.

On arriving at the northeastern extremity of the table land we found it necessary to alight from our horses, and undertake the descent of the hill on foot, as we did when exploring the course of the Ostuta.

The Cerro Atravesado stands completely isolated on every side, except here where it ends in a kind of ridge, and which descending to the valley is joined by another proceeding from the summit of the Sierra Madre.

I resolved to follow the first of these ridges, in order to explore the ground which divides the two rivers, and I was not long in reaching the point where it is most depressed, and from which the relative position of both rivers was perfectly clear and obvious.

Near me, to the west, was the deep ravine through which the Chicapa runs, and to the east the elevated grounds of the bed of the Ostuta, which I had just visited, and which I recognised perfectly at a distance of less than a league. The difference of level between these two points is so considerable, that there cannot be a doubt of the facility of effecting the junction of the two rivers; and it is no less evident that, in the short space which intervenes, there is no obstacle whatever to prevent it. The weather clearing up, I was enabled to make several observations from points still more elevated, by means of which I ascertained beyond all question the favorable nature of the ground, and as no doubts remained on our minds on the subject, I considered the exploration of these parts quite completed.

In these expeditions, as well as those of Coatzacoalcos and others no less toilsome, I was accompanied by my friend and countryman, Don Estevan Maqueo, one of the present proprietors of the Haciendas Marquesanas, in whom the commission found a most useful and willing assistant.

The commission had for a long time entertained a wish to ascend to the highest point of the Sierra in those parts, from whence, in all probability, both seas could be discovered. On this occasion we were about attempting it, but the clouds began again to cover the Sierra, and we had to abandon the undertaking.

Whilst I was engaged in these explorations, Captains Robles and Gonzalez had returned from Coatzacoalcos, after raising the plan of its course from the confluence of the Sarabia to the sea; and un-

der the superintendence of the former they made some astronomical observations, in order to ascertain the longitude of Juchitan, and obtain a trigonometrical level of the principal points of the isthmus.

Want of health did not permit Captain Gonzalez to take, from that moment, any part in the labors of the commission when they required much physical energy and activity, and therefore the operations which were still to be performed for the complete exploration of the isthmus were divided between Captain Robles and myself.

Captain Robles went to ascertain the latitude and fix the situation of Santa Maria Chimalapa, which had not yet been obtained, and afterwards to note the course of the river del Corte from the most elevated point he could reach, as far as its confluence with the Sarabia.

At the same time I undertook to explore the country between Tarifa and the confluence of the two rivers, Malatengo and del Corte. This part of the country is the most fertile and pleasant that it is possible to imagine. Shortly after leaving Tarifa it is truly interesting to observe, mixed together, the spruce fir-tree of the cold climates, the oak of the more temperate, and the palm-tree of the warm regions. Further on, these trees as well as beautiful green meadows of vast extent occur alternately with woods of a luxurious tropical vegetation. Trees of precious woods, wild cocoa, vanilla, &c., are everywhere seen. The plains near the rivers, cultivated by the inhabitants of Barrio, Santa Maria Petapa, and San Juan Guichicovi, give an idea of the astonishing fertility of the soil, since the natives only come in time to burn down the brushwood; they sow without cultivation, and scarcely ever revisit their cornfields until the harvest time.

These very circumstances made the exploration difficult. It being often impossible to examine the ground in any other way but on foot, I found myself beset by the tall shrubs of a luxuriant vegatation, which did not allow me to see any of the surrounding surface.

My principal object had been to find out the best line through which a canal might be opened from Tarifa to the river del Corte, but a great part of the ground is covered by a succession of hillocks so vast and complicated, that it might afford numerous solutions of this problem, and it would be impossible to select the most advantageous site without first bestowing upon the subject a long and careful study. Meanwhile from Tarifa the waters descend naturally to the Coatzacoalcos through grounds by no means too rugged, whilst the very existence of a labyrinth of hillocks, almost all individually isolated, or else joined together by ridges of an insignificant thickness, are sufficient to prove the practicability of the work.

I have ascertained the situation of various points, rectified some erroneous notions previously admitted respecting the course of the principal rivers which flow into the Malatengo, and followed the course of this river from its junction with the Chichihua for about

two-thirds of the distance which separates it from the river del Corte. Throughout the whole of this space its course is neither rapid nor tortuous; and although it was the season when its waters are lowest, it carried a volume of more than fifteen cubic metres per second.

Captain Robles accomplished also satisfactorily the exploration of the river del Corte, although the bad weather and other unfavorable accidents had molested us both considerably.

I immediately set out again and reached the river del Corte, passing through San Miguel and Santa Maria Chimalapa, with the view of inspecting that part of the country which I had not yet visited. Captain Robles at the same time had gone to Juchitan, and made new observations to ascertain the longitude of that place.

I went in company with the same gentleman to San Miguel, and again examined the brow of the Sierra, which limits towards the north, the course of the Chicapa and that of the Monetza, in order to become positively assured that we had not left unobserved any part which might offer an obstacle to the execution of the work. After this last inspection, its accomplishment appeared to us even more easy than we had hitherto considered it.

The commission definitively left the Venta de Chicapa, where they had fixed their residence, and with Captain Robles we went to the Hacienda de Santa Cruz, the village of Chihuitan, and the Rancheria de Comitancillo, the situation of which we fixed on the plan; and with this last operation I had the satisfaction of knowing that none of the places which had been the object of our researches in the isthmus had escaped my personal notice.

On the 25th of March, 1843, after nine months of toilsome labors, we came back to Tehuantepec, to prepare for our return to Mexico, as we considered the exploration of the isthmus to be now quite completed.

In the description of Coatzacoalcos, given by Captain Robles, I have not found anything that does not agree with my own observations and notes, excepting the width of 700 metres attributed to the river near its mouth, where it is widest. Judging from sight only, I had supposed it to be 500 at the utmost; but as Messrs. Robles and Gonzalez measured that distance by means of a micrometer, it is probable that my calculation was incorrect. Besides, this question, after all, is quite insignificant; and I only mention it that the report of our operations may be as correct and accurate as possible.

The following report is literally the same as that which was forwarded to me by Captain Robles after his exploration:

Course of the river Coatzacoalcos.

The river Coatzacoalcos takes its rise in the unexplored part of the Sierra Madre, and the highest point in its course, which we visited, was at its confluence with the Chimalapilla, from whence we examined it all the way to its mouth in the Gulf of Mexico,

situated in 17° 8′ 30″ north latitude, and 94° 17′ west longitude from Greenwich.

Chimalapilla falls into the Coatzacoalcos on its right bank, 7 kilometres to the south-southeast of the village of Santa Maria Chimalapa, and this confluence is 119 metres above the level of the sea. We were assured by the Indians that they had ascended the river still higher than that point on their rafts, during six days, which may be reckoned about 90 kilometres, until they came to the junction of two small streams forming the river, and the course of which was too precipitous to allow of being any longer followed in their rafts.

On the same side, and at a short distance below the Chimalapilla, is the confluence of the river del Pinal, so called because it flows through mountains whereon the pine timber was cut by the Spanish government to be sent to the Havannah for the masting of large ships, and for this reason this part of the Coatzacoalcos is still called the river del Corte, (of the cutting.)

As far as the confluence with the river del Milagro, which enters on the left bank at 2½ kilometres to the west northwest of Santa Maria, the Coatzacoalcos takes a precipitous course through a deep ravine, with a descent of 40 metres in the space of 19 kilometres; that is, 0 21 metres in every 100 metres. The mountains which border the channel are at first very high and precipitous; but gradually lowering and softening in their character as the mouth of the Milagro is approached, they then appear only as hills of moderate elevation, and the river has changed from being a rapid torrent, in which the rafts could with difficulty float, into a quiet stream, with only occasional rapids of small extent. The rocks on the banks of the river are of sandstone, calcareous spar, and slate, although this last but rarely occurs. The limestone is excavated by the river, which thus appears to pass under the ruins of a bridge.

In the few small patches of level ground, on the borders of the river, the Indians of Santa Maria plant maize, tobacco, and cocoa; some of these tracts of land being only accessible in rafts, and others only by very craggy pathways.

The volume of water now filling the river is considerable; for, as I descended, I found it to be about 45 cubic metres per second, and the Indians assured me that it was rarely less.

Beyond the confluence of the Milagro, the river, hitherto running from east to west, follows a general direction towards the southwest, as far as the mouth of the Escolapa, and after that to the northwest, as far as that of the Malatengo. Both these rivers flow into the Coatzacoalcos by its left bank; and the Escolapa as well as the Milagro, and the streams which unite with it, have their sources in the desert part of the Sierra to the east of the road which leads from San Miguel to Santa Maria Chimalapa. The course of the Malatengo and its tributaties are laid down upon the map.

The hills on either side become gradually depressed, and at a short distance from the Escolapa they are very insignificant; nevertheless, the rocks before mentioned frequently show themselves,

forming the rapids already spoken of, and which give rise to many windings, so that the course of the river between the confluence of the Milagro and that of the Malatengo is forty-six kilometres.

Half way between the Escolapa and the Malatengo is the station of the Angostura; so called from two beds of greenstone rock rising in the middle of the river, whilst the banks of the stream, also of the same formation, are very precipitous; so that the channel, which above this spot was thirty metres wide, becomes divided into three, the widest of which is only five metres broad. Some of the rapids are caused by this very rock; but from this place forward they considerably diminish.

As the Malatengo is approached, the hills reappear with more elevation and frequency on the borders, and continue the same beyond its confluence; so that the accession of waters to the Coatzacoalcos is now more perceptible in its greater depth, which from this place to the mouth of the Sarabia is generally from one and a half to two and a half metres, and sometimes even five metres deep, than in its breadth, which does not exceed thirty-five to forty metres.

Next after the Malatengo, the rivulet of Rio Chico joins on the right bank coming from the Sierra of Chimalapa; and at no great distance on the other side enters a stream, near which is an ancient wharf called Mal Paso, so named on account of a strong rapid a little below it, and which caused it to be abandoned. At the present day another loading place is called by the same name, but this is two hundred metres above the Paso del Sarabia, close to the mouth of the river of the same name.

This rapid, which is the strongest to be found after leaving Angostura, is formed of various ridges of calcareous spar and granite, and occupies a space of 180 metres. The first of these rocks frequently occurs at the base of the hills, and often forms smaller rapids.

After the junction of the Sarabia the hills become inconsiderable, and almost entirely disappear a little below the river Jumuapa, (or de la Puerta;) the rapids also are less frequent, and the last of them, called the Suchil, is seen just before reaching the mouth of the river Jaltepec, (or de los Miges.)

The rivers Sarabia, Jumuapa and Jaltepec enter the Coatzacoalcos on the left bank, and next to them the Chalchijapa on the right hand. The two first descend from the Sierra of Santa Maria Guienagate, and although the Sarabia has much water it is not navigable, on account of its course being too precipitous, and having near its mouth a fall which impedes the entrance of canoes; but the Jumuapa can be ascended by them, in the rainy season, to the point named the Paso de la Puerta; from whence the road to San Juan Guichicovi is shorter and better than the one from the Paso del Sarabia. The river of Miges has its source in the sierra of the same name in the district of Villa Alta; and, notwithstanding the rapidity of its current, it is navigable all the year round for canoes to a spot called Tutla, distant twelve kilometres from the village of Trinidad. The distance from Tutla to the mouth, calculating

by the time occupied in ascending it, may be reckoned at eighty kilometres. The river Chalchijapa carries also much water; the Indians of Santa Maria ascend it for five days with rafts, and then cross by land to their village, which is sixty-one kilometres distant from the point where they leave their rafts.

Between the Jumuapa and the Jaltepec the stream Amate runs into the Coatzacoalcos, and between the Jaltepec and the Chalchijapa that of Las Perlas; both on the left bank.

Between the confluence of the Chalchijapa and the point of Horqueta, where the river is divided into two branches, the stream Colorado, the rivers Naranjo and Peñas Blancas, and the stream Cuapinoloya, join the river by its left bank, and the brook Churriagao by the right; the latter and the Peñas Blancas come from large lagoons not far distant.

The general course of the Coatzacoalcos, from the confluence of the Malatengo to that of the Jumuapa, is from south to north; then it runs northwest until it meets the Jaltepec; and thence to the bar its course is northeast. The length from the mouth of the Malatengo to the Sarabia is thirty five kilometres; from the Sarabia to the Jumuapa, twenty-seven; from the Jumuapa to the Chalchijapa, thirty-six; and to the Horqueta, sixty-five more—being a distance of one hundred and sixty-three kilometres between the Malatengo and the Horqueta.

The banks of the river, after quitting the hills, are generally from three to five metres high, without being steep; and they are so low as to be occasionally covered in times of flood. At some few spots called *cerritos*, or hillocks, the banks are from twelve to twenty metres high, and are composed of beds of clay. Among them only the Oajaqueña, Tecolotepec, Churriagao, Peñas Blancas, and Cuapinoloya, are worth mentioning. Below those of Tecolotepec, at the bend of the Cascajal, the river overflows its right bank, and the waters that escape join the river Coahuapa, which unites with the Coachapa, of which mention will be made hereafter.

In consequence of the low and sloping banks which here suffer the river to spread out laterally, and the slowness of the current, which after the confluence of the Jaltepec is scarcely apparent, the depth of the stream does not increase so much as might be expected; and during the dry season shoals are even to be met with covered only by half a metre of water. These shoals are formed of sand and gravel, and almost all of them are small. Those of any extent are, one commencing below Tecolotepec, which occupies the greater part of the bend of Cascajal; another between the river Naranjo and the brook Churriagao; another, that of Cuapinoloya, between the island of this name and one a little lower down; and lastly, that of Horqueta, obstructing the entrance of the two branches of the river which is divided at this point.

These two branches again unite after having formed the island of Tacamichapa. The one to the west, called Mistan, is longer and narrower than that to the east, called Apotzongo; the length of the first is fifty-five kilometres, its width between ninety and

one hundred metres, or about twenty or thirty metres less than the river was before it became divided; and the depth is above four metres. Several streams fall into it, and near the extremity is the creek of Monzapa, which has from three to four metres of water at its entrance, and reaches nearly to the village of Tesistepec. In this creek is found the Paso de la Cienaga, which is only two leagues distant from the village of Jaltipan; and in this same branch of Mistan is the pass of Blancos, at a distance of twenty-one kilometres from the large town of Acayucam, the capital of the district.

The branch Apotzongo is forty kilometres long, and on its right bank, twenty-nine kilometres from Horqueta, is the village of San Miguel de los Almagres, (or Hidalgo-titlan,) the first inhabited place met with proceeding down the river. Below this point, the water in this branch is constantly six to seven metres deep; but a little above los Almagres, between the strands of Mistan-grande and Gaviota, it is impeded by a considerable shoal.

After the junction of the two branches, the Coatzacoalcos receives on its right the rivulet Ishuatepec, the stream of Otapa, and the river Coachapa, the mouth of which is sixteen kilometres from the lower end of the island of Tacamichapa. The source of this river is unknown, and the district it traverses is a desert; it has been ascended in canoes for twelve days, which is the same time as that employed in going up from the bar of the Coatzacoalcos to the pass of Sarabia, and schooners have also sailed up it to a sugar plantation twelve kilometres above its entrance. At a spot three leagues higher up, it receives the river Coachapa, which, as already mentioned, collects the waters that leave the Coatzacoalcos at the turn of Cascajal. The stream Otapa comes from some small lagoons producing salt in abundance.

Seven kilometres below the confluence of the Coachapa, but on the opposite shore, is the village of La Fabricia, or Mina-titlan; and at seven more below this, the river Uspanapan joins the Coatzacoalcos by its right bank.

Half way between the river Coachapa and Mina-titlan is situated on the left bank, in front of an islet, the common entrance to the creeks Tacojalpa, Ojozapa, and Cuamecatan, in which the pine logs destined for the arsenal at the Havannah were formerly deposited.

Of all the villages founded by Don Tadeo Ortiz, only Mina-titlan and Hidalgo titlan now remain, and their situation is indicated on the map.

The Uspanapan is the most considerable of all the numerous tributaries of the Coatzacoalcos; its course is wide, spreading through an uninhabited country; and, although its sources are unknown, they are generally supposed to come from a range of mountains, which is often visible to the southeast from the upper part of the Coatzacoalcos. This range has the reputation of being rich in gold and silver minerals, and has been explored by several expeditions, which ascended the river in canoes for sixteen to eighteen days, and some of them are said to have done this even for twenty-six days. On the banks of this river, at thirty-eight ki-

lometres from its mouth, Mr. Baldwin, of Mina-titlan, built a schooner a few years since.

Below the Uspanapan, near a spot named Paso Nuevo, through which runs the high road leading to Tabasco, the rivulet of San Antonio joins the Coatzacoalcos, proceeding from some marshes twenty five kilometres distant from its mouth.

Finally, at sixteen and a half kilometres below Uspanapan, and eight and a half from the bar, is found on the left the confluence with the river Tierra Nueva, or the Calzadas, this being the channel by which the Coatzacoalcos unites with the river Huasuntan, which empties itself into the sea by the mouth of the Barrilla, not practicable for vessels of any size.

The banks of the river here are very low, and frequently flooded, and there are many creeks; the most remarkable of which are that of Tacoteno, on the left bank, below Paso Nuevo, which reaches back to near Mina-titlan, and that of Coatajapa on the right hand, which flows near the village of Yshuatlan.

The depth of the Coatzacoalcos, from the junction of the branches which form the island of Tacamichapa to the mouth of the Coachapa, is 8 metres, and from this to the bar not less than 10 to 12 metres. Its breadth, where narrowest, is from 120 to 150 metres; and in some places below the mouth of Tierra Nueva it is nearly 700 metres. It will, therefore, be seen that as far as the island of Tacamichapa, a distance of 55 kilometres, (13 Mexican leagues nearly,) or at least up to the confluence of the Coachapa, the Coatzacoalcos is navigable in all seasons and for every class of ships, forming a convenient as well as most secure harbor. Schooners might ascend as far as Horqueta by the branch of Mistan, and to Hidalgo-titlan and somewhat higher by that of Apotzongo.

From the battery on the left shore at the entrance of the river, a clear channel is to be seen through the break in the bar, which we were informed never varies in position; and although we knew well that there is a sufficient depth of water for large ships, (since but a few years ago two large French vessels with colonists had entered the channel,) we examined it ourselves in an open boat, going out to the distance of 3,000 metres, where we found 15 metres water with a rapidly increasing depth. The shallowest water we found on the bar was 6.2 metres, and we were not certain that we had gone over the deepest part of it.* A North American pilot, who resides in the establishment of Mr. Baldwin, assured us that he had many times crossed the bar, and that he had never found less water upon it than 21 English feet, equivalent to 6.4 metres. This account nearly agrees with our own observation, and confirms the old opinion that the bar does not shift, a circumstance easily explained, since the current of the river is slow, and the tides are almost imperceptible at its mouth.

In the vast and dense forests which cover the shores of the river

* When we reached the greatest distance from the land, the rusty shanks of the rudder of our boat broke, and this compelled us to return immediately, without taking any other soundings, as we had intended.

and its tributaries, the finest ship building timber as well as dye-woods are to be found in profusion; those principally seen in the greatest abundance are the tall pine trees of the Sierra de Chimalapa; the noble cedars which line the length of the river especially above the stream of the Perlas; superb mahogany, and other hard and close grained trees, such as javicues, huayacanes, macayos, and paques, from the latter of which curve and fashion timbers were cut in the time of the Spanish government for vessels of the largest dimensions.

The abundance of ship timber which is to be found on the borders of the river itself, the convenience and security of the port, the facility of defending its entrance by placing batteries at the points of the river facing the channel, and which from the nature of the ground might be rendered unassailable from the land side, are all so many combining circumstances to render *the Coatzacoalcos the fittest place in all the Gulf of Mexico for the establishment of an arsenal.* These advantages were first pointed out to the Spanish government by the engineer Cramer, in the year 1774. In 1778 another engineer, Don Miguel del Corral, submitted to the Viceroy a plan for the construction of an arsenal, with two building slips for vessels of every size, and a fort to defend the entrance of the river.

In making our survey we descended the river in canoes from the Paso of the Sarabia to its mouth; from the confluence of Chimalapilla to that of the Sarabia we floated down on rafts; and, in laying down the course, we determined astronomically the latitudes of five points. The intermediate places were observed by compass, estimating the distance, by the time employed in passing along them, which was the only method we could adopt, owing to the matted state of the forest along the banks; and in those places where some of the loops made by the river approach each other in the branch of the Apotzongo the ground was examined on foot by paths which we had to cut for ourselves.

Not being enabled to determine by observations the position of the mouth of the river, we have adopted that laid down by the Spanish naval officers.

In concluding this description of the river Coatzacoalcos, I trust I may be allowed to record my grateful acknowledgments to my worthy relative, Don Joseph Gonzalez, captain of the general staff, who accompanied me on the survey of the lower part of the river, lending every possible assistance to be expected from his activity, talents, and experience, and from whose premature death his country suffered so severe a loss.

In continuation, I subjoin the account of the astronomical observations which were taken in the isthmus, as literally given to me by Captain Robles.

Astronomical observations.

By these the latitudes of eleven places and the longitude of Juchitan were determined, and many azimuths taken. The instru-

ments employed were Borda's repeating circle, of 0.35m. diameter, constructed by Gambey; the reflecting circle, by Cary, of 0.20m. diameter; two sextants, one by Gambey, of 0.20m. radius, and the other by Cary, of 0.15m. radius; and two chronometers, by Roskell, No. 171 and 301.

Observations at Juchitan.—The latitude was determined with the greatest care by circummeridian altitudes of various stars, and that of the Polar star taken out of the meridian, using the circle of Borda for these observations as well as for the altitudes of the sun and of several stars noted for the purpose of regulating the chronometers. The observations here given will show the degree of confidence which may be placed in the calculation of the mean rates:

6 circummeridian altitudes of Fomalhaut (November 3, 1842	16°	26′	15″N.
20 of the Polar star (November 3)	16	26	6
12 of ζ Grux (November 4)	16	26	6
12 of Achernar (November 4)	16	26	14
8 of Canopus (February 18, 1843)	16	26	3
2 series of 6 observations of the Polar star out of the meridian	16	26	9
Mean of these 70 observations	16	26	8.3
Difference of the place where the instrument was situated and the apex of the cupola of the church	0	0	1.7
Latitude of the cupola	16	26	10

Not having had the opportunity of observing the occultation of any star by the moon, the longitude was determined by culminations of one of its limbs with the stars Spica Virginis, Antares, and Regulus, observed by the telescope of the circle placed nearly in the plane of the meridian, and the following results were obtained:

Longitude of Juchitan, west of Greenwich.

By comparison with Spica (February 17)	6h	20′	27″
Id. with Antares (February 21)	6	20	50
Id. with Regulus (March 13)	6	20	43
Id. with id. (March 14)	6	20	34
Longitude of Juchitan	6	20	38.5
In degrees	95°	9	37.5

From the roof of the church, on the 2d, 3d, and 4th of November, 1842, several series of angles were observed by the theodolite between one of the limbs of the rising sun and the signal at Umalalang, to determine the azimuth of the latter, and noting the time by one of the chronometers, the rate of which was well ascertained, it gave 48° 44′ 30″ from south to east.

San Mateo del Mar.—The latitude of this village, deduced from a series of ten circummeridian altitudes of the moon, taken by Mr. Moro, with Cary's sextant, on the 16th of August, 1842, is 16° 12′ 47″, which differs only 7″5 from that obtained by the triangulation.

San Dionisio del Mar.—The laltitude of this place was determined by three series of circummeridian altitudes of the sun, giving the following results:

1st series of 20 observations (October 11, circle of Cary)	16°	16′	36″
2d series of 16 observations (October 13, by circle of Gambey)	16	16	22
3d series of 22 observations (October 16, circle of Cary)	16	16	30
Mean of the 58 observations	16	16	29.8

The latitude, taken graphically on the plan at the spot laid down from two secondary triangles, gives 16° 16′ 32″.

San Juan Guichicovi.—On the 7th of February, a series of ten circummeridian altitudes of the sun was taken with Cary's circle, and the latitude deduced from these was 16° 58′ 35″. On the morning of the same day, and on the previous evening, azimuths were astronomically taken of various points visible from the church and a small neighboring hill, of which the longitude was ascertained to be 4′ 15″ west of Juchitan.

The remaining seven latitudes of places determined by the commission are those of Santa Maria Chimalapa, Hidalgo-titlan, Minatitlan, Paso de la Puerto, the Strand of Jumuapa, the south point of the island Pedernal, and the Horqueta de Tacamichapa. The first, by six circummeridian altitudes of Sirius; the second, by eight of the sun; and the others, by simple meridian altitudes of the sun, taken with the sextant of Gambey. These latitudes will be found with the former in table No. 1.*

In addition to the above, several azimuths were obtained at various points corroborative of the observations taken at Juchitan.

Observations of the temperature and atmospherical pressure were also noted at the same time, the whole of the calculations being made with the greatest care and exactness from data furnished by the British Nautical Almanac.

The commissioners regret that the observations were not more numerous, especially in that part of the country where the triangulation was most difficult; but even such as have been made were only obtained by the most arduous labor. From the frequency and force of the northerly winds, it became impossible to use the artificial horizon, and consequently the reflecting instruments; and

* Vide Appendix A.

even Borda's circle was employed with much difficulty, on account of the continued heavy rains which fell on the mountains at the season of the year when this survey took place. Three successive attempts were made to determine the latitude of Santa Maria Chimalapa. The two first proved quite unsuccessful, having in one instance fruitlessly waited eight days for an opportunity to effect our purpose; and even on the third occasion five days elapsed before we could accomplish our object. At many other places we also waited in vain for favorable weather to make our observations.

Throughout the whole of these labors I was greatly assisted by the lamented Captain Gonzales, whose ardent zeal could not be restrained even in the midst of rapidly declining health.

Geographical positions of the trigonometrical points.

The azimuth of the signal at Umalalang, observed from the cupola of Juchitan, with the latitude of this latter point, served for the calculations of the geographical positions of the vertexes of the principal triangles found in table No. 2.

In these calculations, as well as in the trigonometrical levels, and the construction of the maps, the value of the terrestrial ellipticity has been assumed at $\frac{1}{311}$, as deduced by La Place from the influence which our planet exercises over the moon's motion, and which differs but little from $\frac{1}{313}$, which has lately been found by Mr. Puissant to result from the several geological operations.

The longitude of Juchitan having been determined astronomically, and this point made the basis for all the other positions, their longitudes have been referred to it both in the table and in the maps.

Levels taken trigonometrically.

The altitudes above the level of the sea, contained in table No. 3, have been calculated by zenith distances observed with Borda's circle from the summits of Daniguiati and Palo Blanco and the church of Juchitan, and from the horizontal distances derived from the triangulation. At Daniguiati, a series of ten observations of the horizontal depression of the sea was taken, and by them the height was determined to be 274.5 metres above it, allowance being made for the height of the tide at the time of observation.

The height of Juchitan was ascertained by the preceding, and by two series of observations at that place, and two more at Daniguiati; that of all the following points as far as Palo Blanco were determined by observations made at Juchitan.

Lastly, the height of Palo Blanco, and the zenith distances observed from its summit, served for finding all the points.

Not less than six series of observations were taken at each time for determining the heights; and for the most important as many even as twenty-four.

In order to calculate the co-efficient for the refraction, meteorological observations were made, which, being applied by the pre-

scribed formula, (see the Geodesie de Puissant, 3d edition, liv. 3d, par. 271,) gave the following results:

Values of the co-efficient for refraction.

For observations made at Daniguiati, 0.0715
For observations made at Juchitan, from 0.0723 to 0.0727
For observations made at Palo Blanco, from 0.0684 to 0.0716.

It must be observed that the situation of the highest peak of the Sierra having been laid down by means of sights taken from distant points, which, in consequence of the peculiar form of the mountain, may not always have been directed to the same spot, there may be an error of position amounting, perhaps, to 1,000 metres, which would also occasion another of forty-five metres in the altitude.

Levels taken taken by the barometer.

The commission simultaneously took levels with the barometer, using two constructed by Cary, well compared together, and the results are stated in table 4.

The height of the three first points have been ascertained directly from the level of the sea, by comparing those of Umalalang and Daniguibixo with the result of the geodætical measurements. In both cases we found only the small difference of two metres, the trigonometrical height of Umalalang being less than that given by the barometer, whilst in the case of Daniguibixo it was the reverse.

The height of the Venta de Chicapa is the mean of four series of observations differing but little from each other, which were made simultaneously at that place and at Tarifa, and this last is included in the geodætic levelling.

All the other places, with the exception of the last four, which we took separately, were ascertained by simultaneous observations made at each of them and at Tarifa or the Venta; and those of greater importance by two series at least. The altitudes of San Miguel Chimalapa and Chivela were calculated respectively from each other, and the results were without any sensible difference, equal to those obtained by means of simultaneous observations consecutively made at each of these places and at Tarifa.

All the isolated observations were eventually compared with the means of those previously and subsequently made at the Venta.

On verifying the different results the commissioners are of opinion that barometrical observations determine the *differences* of levels very approximately, when made with due precaution. It is above all things requisite to study well the nature of the country to ascertain the most favorable circumstances for making observations, since the form of the land separating two stations may impede the equalization of atmospherical changes, and thereby produce considerable errors.

The north wind, which frequently blows over the isthmus, brings with it the clouds formed in the Mexican gulf, and these are dis-

charged upon the low grounds of the Coatzacoalcos, towards the northern side of the Sierra and its principal summits, whilst above the opposite slope and over the plain, which extends from the foot of the mountains to the shores of the Pacific, the sky remains constantly clear. If, under these circumstances, barometrical observations are made simultaneously on both sides of the Sierra, on the side of the gulf they will exhibit a lower elevation than the true one, the error being the greater as that station may happen to be lower down or more towards the north; but, if time should admit of waiting until the weather be equally fine on both sides (which seldom happens) then the difference between the levels of the barometrical columns is insensible. Hence, we are unable to give the altitudes of many places where observations were made.

The considerable difference existing between the altitudes determined by us and those given by General Orbegozo ought to excite no surprise, since he himself says, "that the observations made do not deserve perfect confidence, since he had reason to suspect that a small quantity of air had got into the only barometer he possessed, and which he had himself constructed." And although he says afterwards, that he "endeavored to correct the results indicated by his barometer in subsequent observations made at Tehuantepec previously to and after driving out the air from the tube by boiling the mercury in it," nevertheless this correction was unquestionably less than that which was necessary, in consequence of all the air not having been totally expelled, which seems indicated by the circumstance that the differences between his results and ours are always greatest when the altitudes are lowest.

Besides, as the general had only one barometer at his disposal, he may probably have calculated his differences in the heights by taking the mean altitude of the barometrical column at the level of the sea as determined by Humboldt, by which method an error might arise of 30 metres, since we have noticed differences in the barometer at the level of the sea, observed at the same hour of the day, of 0.0055m., half of which difference would suffice to produce the before-mentioned error in the height observed, so that in this way no survey, such as the isthmus requires, could be relied upon. However, this is taking the error at a maximum, but supposing circumstances to be otherwise favorable, this method is still very valuable as a means of extending the knowledge of the physical geography of such countries in which great differences of heights are found at short distances, for the error of 30 metres would not much signify. We have ourselves adopted its application at various points of the journey from Tehuantepec to Puebla, as noted down in table 5.

Geology of the isthmus of Tehuantepec.

From the commencement of the works I perceived the importance of obtaining some accurate information on the nature of the country which was the object of our investigations, and I began at once to collect specimens of the rocks in the several points which

we explored. However, I considered the utility of this operation in a scientific point of view of much less importance than the influence which the quality of the rocks might have in the constructive part of the work, that is, as regards the species of building materials they might yield, and the greater or less facility with which they might be excavated.

The collection having acquired by degrees considerable bulk, we were induced to classify it. Professor Don Andres del Rio, well known in the scientific world, kindly lent us for this purpose his valuable assistance, without which, indeed, it would have been beyond our powers to accomplish.

Captain Robles undertook to write the memoir annexed to the geological map, which is here inserted literally.

Geological description.

The great cordillera of the Andes or the Sierra Madre in this isthmus gradually becomes narrower and diminishes in height; its direction is nearly from east to west, and parallel to the coast of the Pacific, nearer to this than to the Gulf of Mexico, so that the natural division of the waters is about seven times more distant from the latter than it is from the lagoons of Tehuantepec.

Northward of the upper lagoon the Sierra is divided at its narrowest part by a longitudinal valley, through which the rapids of Guichilona and Masahua run, and extending from the base of the Cerro de la Banderilla to between those of Piedra Parada and Rinconchapa; both slopes of the Sierra are precipitous, and that on the north terminates by a flat table-land, 200 metres above the level of the sea. The north side of this plateau gradually descends, and imperceptibly unites with the plain through which the Coatzacoalcos winds its course. Westward and eastward the Sierra again widens, and rises to a great height. From this plateau, which we have called La Mesa de Tarifa, a descent may be effected to the Pacific either by the gap (Portillo) of the same name, or by that of La Chivela.

The principal rocks in these mountains are milk-quartz, granite, sienite, greenstone, argillaceous porphyry, grey-wacke, primitive limestone, slate, hornblende schist, grey-wacke schist, compact limestone, and clay stone. The stratified rocks are so much broken up and disturbed by the plutonic, and so intermixed with them, that their respective relations are with difficulty discernible.

In the narrow part of the Sierra the nucleus is of milk-quartz, which forms the elevated valley of the Guichilona and the Masahua and the Mesa de Tarifa, disturbing the beds of the stratified rocks, mixed up with the fragments of the quartz which has insinuated itself into the fissures. Quartz also appears in the mountains of Palo Blanco Zapata, in some of those near San Miguel Chimalapa, and in the road from this village to the Cofradia, and it extends apparently to the west; but to the east at no great distance it entirely disappears.

The quartz is generally shattered, and in cracks even when found

in detached pieces: sometimes there are blocks of granite imbedded in it, as is the case near Tarifa and in the descent through its gap towards the plain. (Vide geological map.)

The boulders brought down from the upper Coatzacoalcos show that the nucleus of the eastern part of the Sierra consists of granite and sienite; some pieces are of dioretic porphyry; the latter and the sienite are sometimes found on the slopes of the Sierra, piercing the sedimentary rocks, as may be seen between Niltepec and Zanatepec, where the sienite is to be found. In the descents from Guichilona and Chihuitan and the gap of the Chivela the slate and limestone are cut through by the pophyry.

The argillaceous porphyry forms to the east the Cerro Atravesado, intercepting the valley in which the river of Chicapa runs from east to west, and some little hills at the foot of the Sierra near to the town of Niltepec; also to the west it forms the hills of Guichicovi and Xochiapa and probably the other high hills of this range. On these hills the porphyry is accompanied by common grey wacke: near Guichicovi and Niltepec magnetic iron is also found in great abundance.

Slate is seen covering a considerable space, overlaying the quartz and mixed with it in the glens of the Masahua and the Guichilona, on the plateau of Tarifa, and in the neighboring hills; and isolated in the less disturbed strata to the eastward along the Sierra. It is sometimes talcose, and now and then similar to pearlstone, although when submitted to the blow-pipe by Señor del Rio, he found it to be silicate of alumina. Alternating with it are the grey-wacke schist, and a rock of slaty appearance composed of the same substances as the greenstone, called hornblende rock by Lyell, and greenstone schist by Del Rio.

Grey-wacke is abundantly found in the descent of Guichilona and in the hills near Barrio and Petapa. Greenstone appears in this vicinity on the summits of Guievixia, and the peak of Almoloya; on the heights of Zapata and Palo Blanco it is mixed with quartz, and it is found repeatedly on both sides of the valley of Chicapa, and on the southern slope of the Sierra to the east. The schist is talcose on the rise from Niltepec to the Cerro Atravesado, and on the banks of the upper Ostuta; and it resembles pearlstone in the Cerros de Espinosa and Paso Partida, and in the adjoining hills.

In the road from Guichicovi towards the Paso de la Puerta, the older formations are wanting, and quartz and slate reappear.

Compact limestone rests upon the slate, and is also very abundant: it forms the Cerro of Huacamaya, Prieto, Masahua, del Convento, and several others; it is found on the Mesa of Tarifa, along all the south side of the Sierra, on the slopes of Laollaga, and it appears several times in the road from San Miguel to Santa Maria Chimalapa in those places where the sand and claystone have been cut through by the water courses. Having greater consistency than the schist, the limestone slabs have not been reduced to fragments in the same manner as the former, nevertheless they are much dislocated and incline in different directions; sometimes they

are nearly vertical, forming inaccessible mountains, such as Cerros Prieto, Masahua, and Convento. In the last mentioned there are two caverns, in the smaller of which the stream Monetza takes its rise: this same stream penetrates the larger one, and passes through it, on its way to join the river Chicapa. The limestone (sometimes stinkstone) is traversed by veins of calcareous spar and pearl spar, in some of which fragments of diorite are met with; it is an excellent building marble, of a smoky and sometimes of a yellowish and blue ash color, whilst the limestone of the Cerros of Laollaga is dolomitic.

Not far from the Sierra, near the village of San Geronimo, the limestone is pierced by veins and fragments of hypersthene, and forms several hills, amongst which the brook of Zopiluapa takes its rise.

This limestone formation is the same as that found in the centre of the republic on both sides of the great chain, wherein the celebrated cavern of Cacahuamilpa is situated, and which also at Tasco rests upon the same argillaceous and talcose slates as in the isthmus, and this formation is further traversed by metaliferous lodes. Baron Humboldt has designated it alpine limestone (alpinkalkstein.)

The limestone is immediately followed by the sandstone found in Guievichi on the southern side between Niltepec and Zanatepec; in the hills of Piedra Parada and on Banco del Marques; also occupying a considerable space on the same side of the Mesa of Tarifa; and on the opposite side in the Cerros of Chichihua mingled with quartz, and extending on the one hand towards Santa Maria Chimalapa, and on the other towards Guichicovi where it lies upon the porphyry, of which the hills are formed, and now and then upon grey-wacke schist.

When the sandstone is wanting, claystone is then in contact with the porphyry. It is found upon the sandstone between the hills of Guichicovi, Xochiapa, and Gavilanes, and in the road to Santa Maria Chimalapa, and it appears to occupy all the intervening space, but from its greater susceptibility of decomposition it frequently disappears, leaving bare the sandstone beneath.

This last rock, which at a little distance from the Sierra forms also the hills of Ytztaltepec (or Daniguiati) and that of Lagartero, appears to have been upheaved by the hypersthene rock, at the same epoch as the limestone of the hills of Zopiluapa.

In general the sandstone is argillaceous and has a slaty texture, but it is also at times quartzose, as in Daniguiati. The clay slate in the road to Santa Maria Chimalapa passes into jasper, and the boulders found in the bed of the river Coatzacoalcos sometimes indicate this transformation.

In addition to the rocks above named, compact quartz, quartzose and calcareous breccias, and common and variegated marls, are occasionally found. The compact quartz is in layers beneath the slate in the descent from the Portillo de Tarifa, and on the banks of the Ostuta; the sandy marls lie over the sandstone; common marl is

found on the slopes of the Sierra and on the road from Niltepec to Zanatepec; and the variegated marl on the Mesa de Tarifa hills.

On the borders of the Coatzacoalcos rolled pieces of micaceous iron of excellent quality are seen, and also in great abundance in the brooks near Tarifa, so that in all probability the formation is near the estate of that name, perhaps in the slate rock, and evidently very rich.

The compact limestone of the Cerros of Masahua is overlaid by a stratified limestone dipping but slightly, which extends from the source of the salt stream Tolistoco as far as the foot of the Cerro of Rinconchapa, and which, to distinguish it from the former, we have called new limestone in the map.

The upper river Coatzacoalcos traverses a valley of alluvium, in which all the rocks above named successively appear. Between the confluences of the rivers Chimalapilla and Milagro are seen the primitive limestone and sandstone, but very rarely slate; thence to the river Coatzacoalcos appear the greenstone and primitive limestone; and in the great rapid at the ancient shipping station of Mal Paso, the primitive limestone rock rests upon granite. The plain through which the river continues its course to the Gulf of Mexico, is covered by a thick coating of rich mould deposited by the river and its numerous tributaries, and the small knolls on the banks are layers of clay.

On the other side of the Sierra a plain extends to the lagoons and to the Gulf of Tehuantepec, over which are dispersed several hills that will be noticed when speaking of the islands in the upper lagoon. This plain is covered generally by alluvium of quartzose sandstone, underneath which are layers of clay, alternating with others of fine sand, indicating that at some period the sea washed up to the base of the Sierra. The clay is sometimes on the surface, and at other times at a depth of 12 metres.

Near the Cerros de Masahua rises in the plain a spring called La Agua Caliente, which is surrounded with calcareous tuffo. Its heat is 31½° centigrade, or (88¾° Fahrenheit,) and it contains a small quantity of sulphuretted hydrogen.

North of the lagoons there is a small Sierra terminated by the Cerros Tinayix and Prieto. The Cerros of Zopilote and La Cienega also appear to belong to the same range, which, with the Cerros of Buena Vista, Tumactiaxilans and Uniacxial, near the lagoon appear to be of grey-wacke and argillaceous porphyry, and occasionally jasper.

The islands of Mitiac-ix and Arrianquiambah are also formed of very fine grained grey-wacke, whilst the island of Mitiac-xocuen is of porphyry, with a jasper basis.

Trachitic porphyry, with small veins of chalcedony, is found in the Cerro of Camotepec, or Dani-gu, to the westward of the upper lagoon; and in the hills of the Potrero, which lie between this and the lagoon, the highest is formed of porphyry, and the remainder of jasper.

The hills on the two peninsulas, which separate the lagoons, and those of the other islands, are principally composed of greenstone

in layers, pierced by veins of fine grained granite, or by dykes of dioritic porphyry. Granite dykes are found in the hill near the estate of Santa Teresa, in that of Jianstanuc, and in the island of Cerro Prieto; and, when in contact, the greenstone alters to the appearance of basalt, changing to dioritic porphyry on the summits of Umalalang and in the island of Manguix-tiac. The greenstone in the Cerro de Huaxtoco is intersected by bands of tremolana, and under it grey-wacke schist, slates and slabs of prase. The same formation occurs in the Cerro de Maloxuet, on the other side of the canal. On the southern slope of Maloxuet, there is an argillaceous conglomerate, and on that of Umalalang is found a conglomerate of fragments of diorite.

The layers on the two sides of the canal of Santa Teresa having opposing dips, as well as those of the islands of Cerro Prieto and Viagtiac, clearly show the action of an uplifting force in the direction of the canal; and, although no plutonic rock is discoverable in it, yet between the two islands appear those of Monapostiac, with an elevation of 111 metres above the level of the sea; these, with another smaller island, are all composed of irregular blocks of sienite, 6 to 8 metres long; which formation can only be explained, as it immediately occurred to Mr. Moro, on the supposition of the fused materials becoming contracted by cold.

It now remains to notice that part of the Sierra which begins near the sea shore by the Cerro del Morro, and runs towards the northwest, and the Cerros of Tehuantepec, Huilotepec, and San Francisco, which are all composed of granite and sienite.

In the chain of the Morro and in the Cerro de la Cueva is found a porphyritic feldspar, with bands of oxide and hydrate of iron, which is sometimes greatly modified by heat. The Cerros del Tigre, (or Dani-qui-bedchi,) near Tehuantepec, are of dioritic porphyry, traversed by large dykes of sienite; and the Cerro Baxmumbah (near San Francisco) is also of dioritic porphyry, but pierced by a granite dyke, the latter again crossed by granite of a more recent formation.

In the other Cerros of San Francisco, granite and sienite are mixed, and appear to pass one into the other. The Cerros of Huazentlan are of graphic granite, and in those of San Diego and Huilotepec (or Dani-gui-bixo) the sienite is fine grained, accompanied in the latter by a formation of quartz and albite.

In concluding this description we must observe a more complete study of the geology of this interesting part of the Cordillera would have required the exclusive attention of the commission, which had other objects of more immediate interest to accomplish. In presenting these results of our observations we have to claim the indulgence of those persons who can well appreciate all the difficulties attending investigations of this kind. Whatever merit they may possess is in a great measure due to Professor Don Andres del Rio, who willingly undertook the task of classifying the specimens obtained in the isthmus, and we therefore take this opportunity of conveying to him our grateful acknowledgments for his valuable services.

The preceding statement closes the account of the labors of the commission in the isthmus. I have considered it necessary to enter into a minute detail of them, in order to give an idea of the degree of confidence to which the results obtained are entitled; but it will, however, be readily admitted that I might have been much more minute in the details had I wished to enhance the value of my efforts.

For the same reason I have abstained from extending the plan herewith presented. The commission, fully impressed with the importance of their mission, did not wish to assert anything on mere conjecture, nor to be guided by report which so frequently proves erroneous. They would not, in fact, venture a single assertion beyond what they could affirm to have seen and investigated by their own observations. In so doing they acted in accordance with the wishes of the projector, Don Joseph de Garay, who conceived the undertaking with the grandeur it deserved, nor would they otherwise have accepted the trust with which they were honored.

The public, to whom this report is addressed, may therefore trust the correctness and fidelity of the assertions which it contains, ascribing only to inefficiency whatever errors of calculation may have been committed, but by no means to a want of zeal and conscientious diligence on the part of the commissioners.

Projects.

After what has been said in the preceding pages, the facility with which the plan proposed by Don Augustin Cramer might be carried into effect becomes evident. Thus, by conveying to Tarifa the united waters of the Almoloya and Citune, it would be easy to direct them on the one side towards the Atlantic, and then join them on the other to those of Chicapa, either by proceeding across the valley of Monetza, which Cramer does not mention and probably did not know, or by descending along the brow of the hills to the east of the Portillo of Tarifa.

At certain seasons of the year the rivers Almoloya and Citune have a more abundant supply of waters than that which we have mentioned; but even by gathering them into reservoirs constructed on purpose, they would only supply a canal of small dimensions, and therefore of limited utility. Let me, therefore, be permitted to give my opinion on this subject.

The various plans which I am about to submit, are formed on the supposition of the Coatzacoalcos being rendered navigable as far its confluence with the Malatengo, and the Boca barra of San Francisco fitted for the admission of large vessels. Both these ends are, in my opinion, attainable without having to overcome extraordinary difficulties.

The favorable and useful peculiarities of the Coatzacoalcos soon attracted the notice of its early discoverers. Cortes, speaking of the country of which the isthmus forms a part, says:

"I had heard that in a very great river, which runs through the said province and falls into the sea, there was an excellent harbor for vessels; because Ordaz, and those who had accompanied him, had examined it; and as the country appeared particularly fitted for colonization, and there being on this coast such scarcity of harbors, I was desirous of finding one, and establishing there a settlement."

Subsequently, by order of Cortes himself, Ordaz founded the town of Espiritu Santo, four leagues from the mouth of the river, of which only some slight traces now remain.

No one ever visited the Coatzacoalcos, whether acquainted with these matters or not, without being impressed with the facility with which the whole of it might be made navigable.

The stability of its bed is owing both to the slowness of the current, which prevents its excavating the bottom and banks, and to the clearness of the waters, which carry no materials down to make new deposites. The gentleness of the current may be inferred from the fact that its course, with all its windings, from the confluence of the Malatengo to the sea, measures 258,000 metres, with a fall of only 40, namely, 0,000155 of descent for each metre of course.

It has been observed that the bar of the Coatzacoalcos is permanent; and in the plan of its course, raised in 1825 by General Orbegozo, we find, after a lapse of eighteen years, that the same windings exist throughout. The islets and streams are also identical in both number and importance, which seem to promise that whatever works may be necessary to give greater depth to the river will have a permanent result, if they are well conceived and properly executed.

The usual engines might be used, as well as the power of the river itself, by narrowing temporarily its bed more than necessary. This object might be effected by means of dikes constructed with solid piles, taking advantage for the purpose of the useful materials which nature herself offers profusely, in the large trees and excellent clay that cover the banks of the river.

In some parts of the upper course of the river it may, perhaps, be necessary to straighten its course, checking the increased current by means of a lock, and in others to construct solid embankments, so as to limit the width of its bed; but any attempt to determine at present the number and magnitude of these works, would only evince either want of good faith or presumptuous ignorance.

To change the established course of a mighty river is one of the most delicate operations in hydraulics, and requires not only much skill and tact, but a careful study of local circumstances, which cannot be the result of a single inspection, but rather a series of assiduous preliminary labors.

I cannot, however, look upon the difficulties as very great, for I am thoroughly convinced that they would be neither arduous nor expensive to overcome. The two most difficult points are the rapids of the old and the new Mal Paso, where the river runs upon a rocky bed; but these are of limited extent, and the many efficient

means employed in similar cases are too well known to allow of much importance being attached to such obstacles.

With these two exceptions, the remaining rapids are generally caused by shingle and sand banks, and diminish gradually in number until they become very scarce below the river Jumuapa.

After passing the small hill of Cuapinaloya, the Coatzacoalcos divides itself into two branches, called Apotzongo and Mistan. If the former of these were straightened, compelling at the same time the whole of the waters of the river to run through its channel, and obstructing the entrance of the other arm, the shoal of Horqueta would be removed, and the river become navigable for large vessels to a point beyond Cuapinoloya, namely, more than 100 kilometres from the mouth of the Coatzacoalcos.

Before dismissing this subject, I think it necessary to make one other observation. The various authors, who have spoken of the Coatzacoalcos, differ in their statements as regards its depth:

Dampier states it be 14 English feet.
Cramer " 18 Castilian feet at mid-tide.
Orbegozo " 14 Castilian feet.
Robinson " 22 English feet, and more in the rainy season.
The last commission 6.40 metres, or 21 English feet.

These apparent contradictions will disappear, if we observe with Don Tadeo Ortiz that the bar has two canals, the depth of one varying at different seasons of the year from eighteen to twenty-three feet, and that of the other from twelve to fifteen. It is not likely that all have measured the deepest canal; besides, from the opportunity which I had of examining the plan of the soundings made by Cramer, I think I may with certainty assert that the bar has increased in depth.

If regulating the course of the Coatzacoalcos may be productive of some trouble, there would at all events be very little in opening the shoal of the Boca barra of San Francisco, and giving more depth to a canal in the lakes, the bottom of which is nothing but mud and shingle.

These difficulties once conquered, nothing remains but to convey a sufficient quantity of water to an elevated point, from whence it may be distributed and directed on the one side to the Coatzacoalcos, and on the other to the upper lagoon. Both objects may be attained by different means.

First Project.

This would be to open a trench that would lead the waters of the Ostuta to the valley of the Chicapa, and another which, beginning a little above the "Ultimo Rancho," would direct the waters thus collected to the table-land of Tarifa, following the brows of the hills to the north of the valley watered by the upper Chicapa and the Monetza. These two proposed trenches are shown in the plan of the southern part of the isthmus. The point of distribution of the canal would be placed between the Cerro del Convento

and the estate of Tarifa, from whence it would descend on the one side to the Coatzacoalcos, following nearly the natural course of the waters; and on the other, would reach the upper lagoon, descending along the eastern and southern sides of the hills of Masahua, by means of proper locks. By the annexed geological plan, it will be seen that the proposed canal would have to be cut through a soil formed in some parts of an argillaceous rock of excellent quality, and in others of marl, clayish sand, and slates. All these rocks are easy to excavate, and of sufficient consistency to require no revestments. Now and then among the slate the quartz makes its appearance; but we have always found it so broken as to cause no uneasiness whatever.

General Orbegozo saw in the ordinary commissures of the slate a considerable obstacle, supposing that through them the waters might escape; but it would not be at all difficult to remedy this inconvenience, by stopping such joints as might require it, both in the bed and sides of the canal, with a good hydraulic cement; or, still better, by taking advantage of the prodigious quantity of asphaltum found in the environs of Alvarado, which the sea is continually casting on the banks of the Coatzacoalcos, inviting with mute eloquence the industry of man.

The alluvial soil, which extends from the foot of the Sierra as far as the lagoons, being for the greater part sand, might offer another obstacle, were it not that the observations which were made in two different points, at a considerable distance from each other, in the grounds of the Venta de Chicapa, show that at four metres from the surface—that is, at a much less depth than that required for the canal—there is found a very consistent clay, upon which might be erected the revestment walls and other necessary works.

No less firm is the earth that was lately found on opening a well in the village of Juchitan, at more than eleven metres from the surface.

Second Project.

The second combination, undoubtedly easier and more economical than the preceding, would be to direct to the Portillo of Tarifa that part of the canal which goes towards the Pacific, and from thence along the brow of the hills to the east join the canal to the river Chicapa, which would be made navigable as far as the plain.

Third Project.

Another idea occurred to me, which for a moment appeared very enticing; it was that of converting into a lake the valleys of the Chicapa, San Miguel, and Monetza, stemming the united waters of the Ostuta and the Chicapa, and compelling them to rise to the level of the table-land of Tarifa. This new lake would form at the same time an excellent dockyard, and be the point of distribution of the waters from which on the one side they would descend to the Atlantic, in the manner shown in the first project, and on

the other side would follow the course of the river Chicapa, then made navigable. This project, which would place a harbor in the midst of the Sierra, would offer the advantage of rendering unnecessary the excavation of the trenches intended to convey the waters of the Chicapa and Ostuta to Tarifa; but it would require the construction of a dike of extraordinary dimensions, and would have the further disadvantage of causing the connection of several locks, a circumstance that ought to be avoided, not only on account of the great consumption of water which they occasion, but of the consequent delay in the navigation; and I have only been induced to mention it in order to show that the ground lends itself to numberless combinations.

Fourth Project.

It would also be possible to place the point of distribution in the valley of the Monetza, converted into a lake or basin. Near the point where this river joins the Chicapa, it passes through an opening between two hills, so near together that it would be possible to close them with a dike of less difficult construction than the one mentioned in the former project. From this basin the waters might be directed to the Atlantic, by the way before explained; and towards the Pacific, following the course of the Chicapa made navigable. This project would be less difficult to execute than the preceding; but it participates in many of its objections, without offering so many advantages.

Fifth Project.

The plan which I am about to propose seems to me preferable to all the others in every respect, naturally and at once appearing the most simple and economical means of turning to account the topographical advantages of the ground. After having conveyed to the immediate neighborhood of Tarifa the waters of the Ostuta and Chicapa, by the means shown in the first project, the next consideration would be to take advantage of the beds of the rivers, which from that point proceed towards both oceans, regularizing their courses so as to make them navigable. The stream of Tarifa, and the rivers Chichihua and Malatengo, might be followed on the one side, and on the other the Monetza and the Chicapa.

It would not always be possible or convenient to follow the windings of the rivers; but by carefully observing the ground, a considerable saving of labor might be effected in the work of excavation. The windings of the Monetza and Chicapa, judiciously turned to account, would give to the canal a more extensive line in which the locks could be better distributed. The solid rocks through which these two rivers run would afford, both at the bottoms and sides, a firm foundation to the necessary works.

The commissioners do not pretend to have indicated the *only* means of effecting the desired canal transit, much less do they flatter themselves of having proposed the best, and only hope to

have been the means of showing the practicability of the undertaking. With regard to its advantages as a commercial speculation, the following estimate of the necessary expense will afford the best means of calculating them.

Estimate of Expense.

I have arrived at the most difficult and delicate part of our labors. Dutens, speaking of the Caledonian canal, which he visited before its completion, observes that, "in a great undertaking of this kind, it is impossible to pre-estimate the cost of every part." And so it is. The amount of expense is mostly influenced by eventual causes, by the mode of husbanding the funds, and by the skill with which the engineer conducts the work.

If in Europe, where it is comparatively easy to obtain correct data in these matters, it is considered venturesome to name beforehand a sum as the probable cost of an undertaking of this nature, it must necessarily be more difficult to do so in the present case, from the want of the requisite particulars. However, by making use of proper investigations, and tending to over-estimate the expense rather than to diminish it, I trust to come near the truth; nor is it possible to expect more in our present disadvantageous position.

It would be an error to suppose that every portion of the work must, in our case, cost more than it would in Europe. The prodigious quantity of timber of the best quality which the projector is authorized to use at pleasure, in virtue of the grant made to him by government, and which lies profusely in every part through which the canal would pass; the excellent kinds of building stone, the lime, bitumen, clay, and all other necessary materials which nature seems to have taken pleasure in scattering in the most convenient spots; and, lastly, the ground and the waters, the acquisition of which occasions often considerable expenditure, and which, in our case, if it did occasion any at all, would be so trifling as not even to be worth mentioning, are all advantages in favor of our undertaking, and which very few of the same kind in Europe could easily command.

I will not, however, take into consideration these advantages, supposing them to be counterbalanced by other circumstances, and shall, therefore, take, as a guide in my calculations, the cost of an analagous undertaking, generally admitted to have been exceedingly expensive by a combination of adverse circumstances. I will do still more; I will apply these calculations to my first project, which, as I have mentioned, may be considered as the least advantageous, and I will suppose the necessity of excavating the whole of the canal, from the confluence of the Malatengo to the lagoons, without taking advantage of any of the favorable accidents of the ground.

The canal, which I have taken as a model, is the Caledonian, the dimensions of which appear to me sufficient. To alter them much would occasion a considerable increase in the expenditure,

perhaps without a suitable compensation, whilst the alteration required in the dimensions of some of its parts, for the admission of steamers destined to a transatlantic navigation, would not make it much more expensive.

Although the Caledonian canal measures less than 22 English miles of proper channel, if we add to it the cost of cleansing and deepening the lakes, it may be considered as twenty-five miles long, which is equivalent to about forty kilometres. The declivity from the top of the canal is of a medium height of twenty-nine metres on each side, and it has in all twenty-seven locks.

From the statement in the Encyclopædia Britannica (7th edition, vol. 19, page 750) it would appear that the above named canal cost up to 1822, when it was opened, the sum of £905,258, that is, somewhat under twenty-two and a half millions of francs; but, as I find in other works that its total cost was £986,924, or nearly twenty-four and a half millions of francs, I will proceed with my calculation upon this last amount, although less favorable. The writer in the Encyclopædia has probaby excluded from the total expenditure the cost of collateral works, such as bridges, roads, &c., which, strictly speaking, do not belong to the canal.

Each lock of the Caledonian canal cost, upon an average, 200,000 francs, and therefore the whole twenty-seven amounted to five millions and a half.

Deducting this sum from the total cost of twenty-four and a half millions, it will appear that the forty kilometres of canal cost, exclusive of the locks, nineteen millions, and each kilometre four hundred and ninety-five thousand francs.

Selecting the proper ground, the declivity of the proposed canal is:

From the table land of Tarifa to the Pacific ..... 200 metres.
From the same point to the mouth of the Malatengo.. 160

Giving to it a number of locks proportionate to that of the Caledonian canal, there would be required:

On the side of the Pacific.....	89 locks.
On the side of the Atlantic.....	72 do.
Total number of locks.....	161

But the number of locks depends in a great measure on the accidental form of the ground; and, these permitting, there might be given to each lock a fall of three metres, in which case their number would be reduced

On the Pacific side to.....	67
On that of the Atlantic to.....	53
In all.....	120

However, to come nearer to the existing data, and because it

might be necessary to put one or more locks below the confluence of the Malatengo, we will suppose that the total number of necessary locks is 150.

The longitude of our canal would be 80 kilometres.

The trench, intended to convey to Tarifa the united waters of the Ostuta and the Chicapa, would be about 25 kilometres in length, and we will give to the section of its excavations 40 square metres of surface. We will take 10 francs as the cost of excavating a cubic metre of ground, according to what is actually paid in Mexico and the United States for similar work in soils analogous to that of the isthmus.

The trench necessary to join the Ostuta to the Chicapa might be five kilometres in length at the utmost, and allowing for unforeseen obstacles in this part of the country on account of the nature of its rocks, we will suppose it to cost three millions of francs.

Lastly, let us apply four millions more to regulate the course of the Coatzacoalcos and to excavate the lakes and the Boca barra.

Then, summing up the preceding calculations, the total amount of the work will be found to consist of the following sums:

Cost of 150 locks at 200,000 francs.....francs	30,000,000
" 80 kilometres of canal at 475,000 francs.	38,000,000
" 25 kilometres of trench at 10 francs per cubic metre.....	10,000,000
" 5 kilometres of trench at 15 francs.....	3,000,000
Regulation of the Coatzacoalcos, lakes, and Boca barra.....	4,000,000
Total cost.....francs	85,000,000

Important observations to the preceding estimates.

I said at the commencement that it was my intention to exaggerate the cost, and it cannot be objected that this promise has not been fulfilled in the preceding calculations: for not only have I laid aside the real advantages which the nature of the ground offers to the execution of the work, by adopting the least favorable project, but I have also fixed prices, certainly exaggerated, and by no means probable.

1. The trenches, which from the neighborhood of Tarifa convey the waters of some torrent streams to the river Monetza with which they enter the valley of San Miguel, would decrease the work in the point of distribution.

2. I have calculated as having to open the whole of the canal, whilst, as we have seen, advantage might be taken of part of the beds of the rivers which run towards the two opposite seas from Tarifa.

3. Both the length of the trenches and the section of their excavation may be greatly diminished by constructing some dike across the valley of the Chicapa, and taking advantage of the favorable shape of the brow of the Sierra in some parts.

4. In the Caledonian canal it was found necessary to build a considerable number of bridges, whilst none are required in our case; therefore it is evident that the average cost for each kilometre of canal which I have adopted is excessive.

5. It must have been observed that I do not pretend to attach any importance to the traditional notion of the existence of a lake, which gives origin to the rivers Ostuta and Chicapa; but if this were true (and it must be admitted that there is nothing impossible in the assertion) the union of the two rivers might probably be accomplished at their source, causing thereby an economy of some millions.

6. Among the expenses of the Caledonian canal there was a sum of £47,956; that is, more than a million of francs, paid for the acquisition of the grounds occupied. In the isthmus, those which are not lay or waste lands, and therefore the only portion that does not belong by right to the projector, are so utterly insignificant as to their value that it is scarcely worth mentioning. It is, indeed, hardly possible to give an idea of the small value of the ground, even the most fertile in these vast and wild regions, and I will only say that if it were desirable to turn into a lake the valleys of Chicapa, Monetza, and even that of the village of San Miguel itself, the amount of indemnifications to be paid would be considerably under any supposition that might be made in Europe, however underrated it might appear.

From all the circumstances just mentioned, and from the knowledge I have of the localities, I am authorized to infer that the preceding estimate may be considerably modified, and I do believe that if the most eligible project were adopted, the total amount of the work would not exceed 60,000,000 francs; besides, the sale of a small portion of the fertile grounds granted by the government to the projector, and the valuable produce of the country, which from this moment might be turned to account, would procure annually no small portion of the funds requisite for the work. Neither would it be necessary to wait until its completion to establish a commercial communication between the two oceans; for the river Coatzacoalcos might soon be made navigable, and the Boca barra of San Francisco fitted for use.

A lateral line of rails for the conveyance of merchandise might also be added to that which must at first be laid down for the progress of the work.

I hesitate not again to repeat that these projects, which are based on data still imperfect, may probably be not *the best* for the accomplishment of the desired object; but if any of them should appear admissible, it must be an inducement for the execution of a work, the peculiar circumstunces of which must necessarily improve the conditions of the enterprise.

Fortifications.

With the view of not leaving any part of my instructions unfulfilled, I will say a few words respecting the mode of protecting the

canal against the insults of a foreign enemy; but I will not go beyond general indications, as I had no opportunity of performing the topographical observations requisite for tracing out a plan of fortifications. The portions of the canal which it would be necessary to protect would be the two extremities.

On the north, the small fort called Fortin de la Barra del Coatzacoalcos, was built by a spanish contractor more than seventy years ago, for the protection of some timber felling. It consists of a building somewhat resembling barracks, with an ill-constructed barbet battery on the left side of the river's mouth, and impossible to defend. In front it may be approached within pistol shot unperceived, and on the sides it is completely exposed. As early as 1778, the engineer Del Corral proposed to substitute for it a small fort with four bastions.

Don Tadeo Ortiz was of opinion that the small hill on the opposite side of the river, which is more extended and healthy, and with waters always fresh, offered greater advantages for the construction of a fort.

At all events, it would be advisable to occupy both places, although not with works of equal importance; but the best protection for the harbor of Coatzacoalcos would arise from the facility of multiplying its defences by establishing batteries in appropriate places along the course of the river, which is admirably adapted for this purpose.

On the side of the Pacific, the upper lagoon, when converted into a port, could readily be protected from the danger of an attack. On both sides of the canal of Santa Teresa might be placed formidable batteries, protected by two forts conveniently situated in the Maloxuet and Huastoco; and various islands scattered in the upper lagoon would afford the means of rendering it impossible to force an entrance.

I will, lastly, observe that the government of Mexico having declared that the canal once effected should be neutral and free for all nations, the general interest of these alone would constitute its greatest and most effectual defence.

Statistical notices of the isthmus of Tehuantepec.

Although the topography of the isthmus has been hitherto but imperfectly known, the fertility of its soil and the salubrity of its climate have been long acknowledged.

These favorable circumstances were observed by the Spaniards even at the time of the conquest, and have been subsequently confirmed by the reports of all who have explored these interesting regions. Another great advantage in connexion with them, is the certainty of obtaining at any time a sufficient number of workmen should any of the proposed plans be carried into effect, particularly as, by a fortunate coincidence, it happens that the most densely populated parts of the isthmus are precisely those where the most important works would have to be executed. Robinson, who knew well the locality, said, in reference to this subject:

"If, on a topographical survey of the isthmus, it shall be found practicable to cut a canal, there is no place where such an undertaking could be accomplished with such ease, as in the province of Oajaca. In its boundaries are comprehended a great part of the isthmus of Tehuantepec. Its salubrity is unequalled on the American continent; even its shores on the Pacific ocean appear exempted from the usual diseases which afflict the inhabitants of the Atlantic and South sea coasts.

"The population of Tehuantepec are among the most active and healthy race of Indians we have ever seen, and the cutting of a canal through such parts of the isthmus as an accurate survey shall show to be the fittest for that purpose, could be performed with the greatest facility by the inhabitants of Oajaca."

These most important advantages were also appreciated by Mr. Michel Chevalier, who lately visited America, and who, speaking of the isthmus, in one of his recent publications, (Revue des Deux Mondes, January 1, 1844,) says:

"The exploration of General Orbegozo confirmed the presence of a magnificent vegetation in the isthmus, which proves the fertility of its soil. Even previous to the voyage of Humboldt, the beautiful forests of Tarifa had attracted the attention of the court of Spain. The fertility of the extensive plain of Tehuantepec was also ascertained, no less than the healthfulness of the country at some distance from the sea. Besides it being well known that the isthmus was once densely populated, there seems to be no reason why it could not be so again."

During the long sojourn of the commission in the isthmus, they had often to undergo hard and severe toils, and were frequently exposed to the most trying inclemencies of the weather, and yet neither themselves nor their numerous attendants experienced any illness indicative of an unhealthy climate. I shall in the following pages refer to these circumstances more at length.

I know how important it would be to give here an exact account of the valuable produce which constitutes the natural wealth of the isthmus; but as the paucity of my information on the subject, the difficulty of obtaining accurate data, and my fear of exceeding the limits which I have prescribed to myself do not permit me to enlarge upon the subject so much as its vastness would require, I must be content with making a few brief and necessary observations. I am, for the same reason, prevented from giving in full the report of the secretary, Don Pedro de Garay, who especially applied himself to collect information on this point; but whenever I make use of any fact acquired by him, I shall not fail to mention it.

The isthmus of Tehuantepec belongs to the Mexican republic, and forms part of the departments of Oajaca and Vera Cruz. According to the official reports, published by the Mexican government in December 10th, 1841, as a basis for the elections, the former department contains a population of 500,278 inhabitants, and the latter, 250,380.

The boundaries of these two districts in this part of the Mexican

territory are not yet definitively settled. The line of division is generally considered to coincide with the course of the river Sarabia, but this would only fix the limits on the left of the Coatzacoalcos, and by no means on the right.

This want of a defined boundary is a natural consequence of the present state of the country. The two extremities of the isthmus are the only inhabited portions, and they are separated from each other by an immense forest of astonishing beauty, which, from the richness of its natural produce, contains evidently treasures of incalculable value, but which with its luxuriance conceals the aspect and form of the hitherto unexplored soil on which it stands.

To proceed methodically I shall divide the statistical notice of the isthmus into two distinct parts, treating successively of the different branches which belong to each department, and beginning by the most southern, namely, that of Oajaca.

SOUTHERN DIVISION.

Department of Oajaca.

This part of the isthmus is topographically divided by nature into two sections. The first occupies the plain which extends from the Pacific ocean to the foot of the Sierra, and the second belongs to the Sierra itself.

Politically, the southern grounds of the isthmus constitute the greater part of the district of Tehuantepec, and comprise twenty-four municipalities; the town of Tehuantepec, which the Spaniards called also Guadalcazar, is the head of the district, and the residence of a prefect, a judge of first instance, a military commander, and a parish priest. Juchitan and Petapa are the heads of two sub-districts with their respective sub-prefects.

Ecclesiastically this portion of the isthmus is dependant on the diocese of Oajaca, and in addition to the parish of Tehuantepec has five rectories.

Inhabitants.

The whole of the southern territory of the isthmus contains about 31,000 inhabitants, as may be seen in table No. 1, obtained by the researches of Don Pedro de Garay, who declares himself to be indebted for his information "to the zeal of the authorities, and to the accounts of trustworthy and unobjectionable persons," an assertion which gives to this document the required value and authenticity.

The population of the southern division of the isthmus is composed of Europeans, Huaves, Zapotecos, Mijes, Soques, and Zambos.

The *Europeans*, as regards numbers, constitute an insignificant part of the population, and are disseminated over various localities.

The *Huaves* are in all little more than three thousand, and occupy the four villages of the coast called San Meteo, Santa Maria, San Dionisio, and San Francisco.

These natives are easily distinguished by their aspect, which differs materially from that of the other inhabitants of the isthmus. They are generally robust and well formed; some among them evince a high degree of intelligence, but the majority are so grossly ignorant as to differ little from a savage tribe.

According to their own traditions, they are not indigenous of these regions; they pretend to have descended from the Peruvians; but, from some idiomatical analogies, it is supposed by some persons that they originally came from Nicaragua.

During our residence at San Mateo, we thought we observed the Huaves celebrate a clandestine festival on the 21st of June, the day of the solstice, as was the custom with the Peruvians, and they appeared also to hold a feast the next new moon.

The Huaves say that, in consequence of a disastrous war, they had to embark and fly from their own country. They all believe that they reached the isthmus by navigating along the coast, and that the first place they occupied was San Francisco, from whence they afterwards extended themselves.

Considerations of local interest keep these four villages, or republics, as they are called by themselves, in a state of constant warfare; and even the language has become so corrupt that the inhabitants of the one village can scarcely understand those of another.

According to an ancient manuscript, obtained by the secretary of the commission, the Mijes occupied the whole of the isthmus at the time of the conquest by the Huaves; but the former, after having offered some resistance, were finally conquered by the latter, and forsaking the plain, they betook themselves to the mountains, which they still enjoy.

The Huaves of both sexes are habitually in a state of almost complete nudity. Their industry consists of little else than fishing, and even this they can only do by means of sweep nets; with the produce of their fisheries, however, they carry on an extensive trade, although not possessing proper vessels to venture into deep water; and being ignorant even of the use of the oar, they only frequent those spots which, from their shallowness, offer little danger, such as marshes, and the margin of the lakes and of the sea. It is a singular fact that, although the Huaves are chiefly fishermen, very few among them know how to swim.

I have attended some of their festivals, the ceremonies of which still preserve the type of their ancient customs; and I regret that my limited space compels me to omit the description, and impart to others the lively interest with which they inspired me.

The *Zapotecos* constitute the greater part of the southern population of the isthmus, and almost exclusively that of sixteen villages out of twenty-four. According to the manuscript above mentioned, as obtained by the secretary of the commission, Montezuma, emperor of Mexico, after subjugating the Huaves proceeded to the conquest of Guatemala, but whilst he struggled with the difficulties of the war, Cosijoesa, king of Teozapotlan and of the Zapotec nation, assisted by the king of Misteca, drove the Mexi-

cans away, took possession of Tehuantepec, and maintained the Huaves in subjection.

The gallant defence which he afterwards made against the Aztec legions ended in a treaty of friendship, and Cosijoesa married a daughter of Montezuma, called, from her beauty, the *flake of cotton*. They had a son, Cosijopi, which signifies *thunderbolt of the air*, who reigned at the time of the conquest of Mexico by the Spaniards.

Cosijopi was baptized and received the name of king Don Juan Cortes de Montezuma. He was a magnanimous prince, generous to prodigality; it was by his command that the church and convent of Dominican friars was built at Tehuantepec; but it having been discovered that he had not entirely forsaken the worship of his original deities, he perished, despoiled of his dominions and liberty.

Although Cosijopi did not offer any resistance to the Spaniards, the Zapotecos opposed their progress towards the interior. Cortes, speaking in one of his letters of two provinces which he intended to conquer, says:

"The people of one of them are called Zapotecos, and that of the other Mijes; which provinces are so rugged that they cannot be traversed even on foot, since I have twice sent troops to conquer them, and they have not been able to succeed, these people being very strong and well armed, and the county almost impassable."

Even at present, whenever the opportunity offers, the Zapotecos maintain the fame for valor which they have always enjoyed.

The natives of Tehuantepec are, by their civilization, incomparably superior to those of any other part of the republic, and their intellectual qualities are of no mean order. I have generally found them intelligent, industrious, docile, and joyous.

In point of personal appearance the Tehuantepecans are vigorous, and of a pleasing aspect, and I may say, that of the Indians with whom I am acquainted, they are perhaps the only people who possess what may be called a *fair sex*.

It appears evident to me that these qualities are not inherent to the Zapotec race, but a consequence of their admixture with the Europeans; for I have observed that the Zapotecos, who inhabit the mountains, and the valley of Oajaca, are similar to the natives of the rest of the republic, and bear no resemblance whatever to those of Tehuantepec, among whom there are many with light hair, and a complexion comparatively fair.

It is well known that Cortes had collected a great number of Spaniards in the isthmus, which was his favorite spot. The women of Tehuantepec enjoy some celebrity in the republic for their charms; and the predilection which they show towards the Europeans, together with a rather over degree of sociability, render this supposition very probable. While speaking of the women of this part of the isthmus, I will add that they are also noted for their graceful carriage, and the regularity of their features; their gala-dress is picturesque, rich, and elegant, as well as the head-dress which they generally wear.

On the coast of the Pacific there grows in great abundance a kind of rush called *chintule*, the roots of which have a pungent aromatic odor. An infusion of these roots imparts their fragance to the water, which the people of Tehuantepec use as a luxury highly esteemed, both for the purpose of washing the wearing apparel, and for their personal ablutions.

A description, though imperfect, of the manners and customs of the Zapotecos, who inhabit this part of the isthmus, would require more space than I can now devote to the subject; I will therefore only add, that they are not without some branches of industry. In Tehuantepec, in particular, there are bakers, carpenters, smiths, tinkers, silversmiths, tanners, shoemakers, saddlers, and as the secretary of the commission observes in his notes, every family, whatever may be their circumstances, manufacture the soap necessary for home consumption. The clothes woven by the women from wild silk and cotton are really admirable, particularly considering the very imperfect instruments which they possess for the purpose.

The *Mijes* constituted formerly a powerful nation, and they still occupy the land from the Sierra, north of Tehuantepec, to the district of Chiapas. In the isthmus they only inhabit the village of Guichicovi, and a small portion of the Sierra, which is never visited.

Physically and morally speaking the Mijes are a degraded race, of a repulsive aspect, and most grossly ignorant. They are, however, given to agriculture, and they grow plantains, maize, beans, and sugar cane, from the latter of which they extract an impure kind of sugar, and they may be said to supply with these articles the southern division of the isthmus.

A favorite object of the ambition of the Mijes of Guichicovi is that of possessing the greatest possible number of mules, a circumstance not easily accounted for, considering that they make no use whatever of these animals, not even for the carriage of their goods, which they prefer carrying on their own shoulders.

The Mijes are notorious idolaters, and they frequently pollute the altars of the Catholic temples with the blood of birds which they offer as victims to other deities.

According to the information collected by Don Pedro de Garay, the number of these people is about 5,000; but Don Tadeo Ortiz, I do not know upon what authority, calculates at twice that number those who profess idolatry. For my own part, seeing that they attend the Catholic service not only without reluctance but even with apparent pleasure, I feel persuaded that they have in their minds an absurd combination of the religion of Christ with their ancient superstitions.

The *Soques*, who came originally from Chiapas, inhabit in the isthmus only the villages of San Miguel and Santa Maria Chimalapa. They are easily distinguished from the other inhabitants of these regions by their peculiar features, but I can scarcely tell whether their appearance is more or less unpleasant than that of the Mijes.

In point of morality the Soques appear somewhat more rational than the Mijes; and contrary to these they are naturally kind and obliging, so much so, indeed, as to become tiresome with their obsequious offers.

It appears that formerly they occupied also the village of Chimalapilla, which stood on the banks of the river of the same name, one of the confluents of the river del Corte. According to tradition the population of this village was completely destroyed more than a century ago by the small-pox, and the few inhabitants who survived the epidemic joined those of Santa Maria.

It is the general opinion, supported by historical record, according to Don Tadeo Ortiz, that at the time of the conquest by the Spaniards there passed near Chimalapilla a road which connected these districts more directly than they are at present, with Tabasco and Chiapas; but my observations respecting the nature and form of the Sierra induce me to doubt the accuracy of this assertion.

The *Soques* cultivate the scanty supply of maize required for their own consumption, a small quantity of tobacco, and two plants belonging to the family of the *bromelias*, from which they extract the *iztle* and the *pita*, the fibres of which they can bleach, weave, and dye of different colors. Their spun materials, and the hammocks which they weave with them, constitute their chief industry and commerce.

The inhabitants of Santa Maria extract also some annotto, and supply the whole of the southern part of the isthmus with the delicious orange, which grows abundantly about their settlement.

The *Zambos*, a half-cast between the Indian and the negro, are chiefly found in the estates of the Marquisate del Valle, and also mixed with the Zapotecos in the villages of Zanatepec, Niltepec, Petapa, Barrio, and Santo Domingo.

The Zambos descend from the African slaves introduced in the Marquesanas estates by the successors of Cortes, and in the Frailescas possessed by the Dominican friars in the territory of Zanatepec. They are robust and industrious, working as laborers in the fields, and applying themselves to the cultivation of wheat, indigo, and cochineal. Unfortunately neither the Zambos nor the other natives of these districts are remarkable for their sobriety.

Climate.

The climate of that portion of the country, which in this part of the isthmus extends from the shores of the Pacific to the foot of the Sierra, is in general warm and dry, a circumstance to which no doubt it owes its salubrity.

The heat is not equally intense in every part of the plain. Tehuantepec, situated in a sandy ground, open to the south and encircled on every other side by hills which prevent the approach of breezes, the coolness of which mitigates the heat of a burning sun, is without doubt the hottest spot in the isthmus. We have often seen the centigrade thermometer at seven o'clock in the morning rise to more than 33° (92° of Fahrenheit.)

Zantepec is also subject to excessive heat in consequence of the proximity of the mountains which shade it on the northern side. The other villages, especially those near the sea, being at a greater distance from the mountains, are freely exposed to the northern winds which blow almost incessantly in these regions, and they consequently enjoy a much milder temperature. The winds proceeding from the north, being as it were confined within the great valley formed by the interruption of the grand chain of mountains between Tarifa and Petapa, descend with considerable force through the openings in the gaps of Tarifa and Chivela. The Venta de Chicapa, situated opposite the former, receives these currents at times very impetuously, and they are also often felt by travellers on arriving in front of the Portillo de la Chivela.

The climate of the elevated section of this part of the isthmus is so different from that of the plains, that when the thermometer stands in the latter place at 30°, it scarcely rises to 13° at Chivela or Tarifa. In all the heights surrounding these estates, we find the pine *ocote*, the presence of which clearly indicates a very temperate climate. This considerable difference of temperature appears much more strange considering that the absolute elevation of Tarifa is not more than 200 metres, whilst its latitude is less than 17°. Our surprise ceases, however, when it is remembered that Tarifa participates in the temperature of the Sierra, which, near to it, reaches suddenly an elevation of more than 2,300 metres.

The summits of the Sierra Madre are almost constantly enveloped by the clouds, which, coming from the Atlantic, there discharge themselves; a circumstance that accounts for the rivers of the isthmus having an almost constant body of water during the greater part of the year. At Guichicovi and Santa Maria Chimalapa it rains almost incessantly, and often also at San Miguel. Whenever such is the case, the table land of Tarifa is covered with a kind of thin mist, which disappears upon reaching the Portillo, where the reigning wind becomes more powerful. This phenomenon may be considered permanent, the suspended mist rarely extending beyond the table land of Tarifa. Thus the Venta enjoys an almost constant unclouded atmosphere, and rain seldom falls in the plains.

In conclusion, I will observe that, among the advantages offered by the isthmus of Tehuantepec for the execution of the proposed work, that of a mild and healthy climate, precisely in those localities where the assistance of European workmen would be required, is by no means the least considerable. The small rains of Tarifa and of the valley of San Miguel are not of sufficient consequence to impede the continuation of the work during a considerable portion of the day.

Natural productions.

At the commencement of our exploration, it was my intention to have formed a collection of the more remarkable plants and animals of the isthmus, but I soon perceived that so vast an undertaking would require the assiduous co-operation of several natural-

ists, and was moreover incompatible with the labors which constituted our principal object. My information upon this subject is, therefore, very limited; and, in submitting the following observations to the public, I have to solicit the indulgence of the well informed reader.

Minerals.

Our geological collection will give a sufficiently clear idea of this department of my subject. Iron is found in abundance in many points of the isthmus, and that of Tarifa especially appears to be of excellent quality. As regards the precious metals, which made the department of Oajaca once so famous, there is a tradition still prevalent from the time of the conquest that the mountains of Mijes and the upper Uspanapan contain very rich gold and silver mines. It may be well to observe here, that, besides the hot water springs already mentioned in the geological section, there is another which we did not visit, in a place called Aguas Calientes, (hot waters,) at a distance of twenty-five kilometres west of Tehuantepec.

Vegetables.

The mangrove tree, (rhizophora mangel,) of sinister omen, is not so common on the coasts of the isthmus as on others of the republic. In the southern division, it can only be found in the neighborhood of San Francisco and of the Morro.

In the peninsula of San Mateo and Santa Maria, the most remarkable plants are the tamarind, the palm, and the cocoa-nut trees, besides which the ground is also covered with vegetation. Three different species of the sensitive plant are here found in abundance, one of which attains to nearly a metre in height.

The land to the north of the lower eastern lagoon, in which the estates of the Huaves of San Dionisio and San Francisco are situated, appear clothed with a luxuriant vegetation, somewhat resembling that of the parks in Europe. The flowers in some of these localities are of astonishing beauty.

Between the coast and the Sierra the plain is partly covered by acacias, which, as we shall presently see, might furnish a considerable quantity of gum.

On approaching the Sierra the vegetation is more vigorous, and the Brazil-wood tree, (cœsalpinia crista,) of which considerable fellings might be effected, becomes very common. The granadillo, the mahogany tree, (svictenia mahagani,) the copalchi, (croton cascarilla,) the bark of which is a well known febrifuge, and the dragon tree, (pterocarpus draco,) begin to make their appearance, as well as many other shrubs unknown to me that yield resins and balsams, to which the natives ascribe the most marvellous virtues. There are also the fustic, (morus tinctoria,) and, according to Don Tadeo Ortiz, the logwood, (bœmatoxilon campechianum,) as well

as a considerable number of other trees, both picturesque and useful for their flowers and the hardness and durability of their wood.

Both the soil and the climate are favorable to the cultivation of indigo and the sugar cane; and those tracts of land which are protected from the winds produce cotton of superior quality.

The table land and hills between Tarifa and the Barrio appear covered with good grass, which affords an excellent pasturage for cattle. The dales are peopled with palm trees, and a little higher up we find the ocote pine, (pinus religiosa?) which has some affinity with the pinus picea. The latter tree is also found on the summits of the hills between the above mentioned places and Santa Maria Chimalapa, alternately with the tropical plants which grow in the lower portions of the ground.

It is impossible to describe with effect the luxuriance of the vegetation in the latter places; but among the prodigious multitude of plants, however, the *guayacan*, (diospyros lotus,) the cedar, the mahogany, the rose-wood, the *gateado*, and the ebony, are particularly abundant. No less worthy of notice are the amber tree, (liquidambar styraciflua,) from which is extracted the resine of the same name, and the tree yielding the balsam of Peru, (myroxylon peruiferum,) and the ocozotl, producing a gum very similar to the true amber.

Innumerable species of fruit trees also luxuriate here, among which are found two kinds of vine bearing fine flavored grapes, the plaintain, the orange tree, two species of spontaneous cocoa, (theobroma cacao,) and the sapota tree of various kinds. The abundance of these is so considerable, especially that of the mammee sapota, that the Indians are accustomed to cut down the tree to gather the fruit more readily.

There are likewise several kinds of indigoferas; the bixa orellana, from which the annotto is extracted, the sarsaparilla, (smilax salsaparilla,) the ginger, (amomum zingiber,) and two kinds of vanilla, very common, and of which no use whatever is made. This precious plant is also found in great abundance on the hills west of Petapa.

The Cerro Atravesado has on its summit a table land, at the northern extremity of which rises an isolated peak. It is covered with excellent pasture grass, and a splendid wood of ocotes. The fissures by which this table land is intersected are constantly supplied with delicious water by the frequent rains; and, when these are considerable, the superabundant water falls perpendicularly over the western side, forming a cascade nearly one thousand metres in height. The edges of the fissures are richly ornamented with zamias, ferns, and orquidaciæ, of great beauty.

The southern side of the most elevated portion of the chain appeared to me profusely covered with majestic oak trees.

To the right of the upper Coatzacoalcos, or river del Corte, are found in astonishing abundance various kinds of pines, and among them it would appear is the pinus abies which the Spanish government used to send to the dock-yard at the Havannah for the construction of ship-masts. According to Don Tadeo Ortiz, many of

these trees are from two to four metres in diameter, and of a prodigious height; they are found at the very banks of the river. The plains watered by the rivers Malatengo, Chichihua, and Almoloya (the latter of which takes in its lower course the name of Guelaguesa) are noted in the isthmus for their delightful aspect. When speaking of the exploration of these rivers I have alluded to this fact, and therefore I will now only add that the vegetation in them is similar, and perhaps even more luxuriant than that of the low grounds on the road to Santa Maria. The soil and climate are likewise peculiarly adapted to the growth of maize, coffee, cocoa, tobacco, rice, and the sugar cane.

On the road from Boca de Monte to the Mal Paso the vegetation begins to assume an aspect peculiar to the plains of the Coatzacoalcos. The laurus sassafras, the fern tree, an infinite variety of palms, and the plants of the tropical regions already alluded to, united and interwoven with passion flowers, and innumerable filamentous reeds, or richly enveloped and crowned by a multitude of exquisitely beautiful orquidaciæ, formed an admirable and sublime spectacle. But the peculiar characteristic of these shrubberies is, that the plants concealed in the midst of this luxuriant vegetation appear desirous to reach as soon as possible an elevation where they may enjoy the rays of the sun, thus acquiring an extraordinary height, and their stems being remarkably straight.

The Sarabia also runs through groves and woods of great beauty, the soil of which seems to be waiting only for the helping hand of man to yield with profusion the natural riches it contains.

Animals.

In every one of the different estates of the isthmus a *tigrero* (tiger-man) is kept, who with a numerous pack of hounds is exclusively engaged in destroying the wild beasts that cause serious damage among the herds of cattle, notwithstanding the immense number of deer, hares, and rabbits on which they could and do also prey. As soon as the dogs discover one of these animals they set off in pursuit, and soon compel him to climb a tree for protection, where he is quickly despatched by the tigrero's rifle.

The wild beast most common in the isthmus is that which is improperly called a tiger by the inhabitants of the republic, it being in reality the ounce (felis uncia;) after this comes the American lion or puma (felis discolor;) they are both numerous, although I have never heard of their attacking man, probably because they have other prey in abundance. The ocellots or small tiger, (leopardus pardalis,) the wild cat, and particularly the American fox, (vulpes fulvus,) are also very numerous in the isthmus; but their skins are not turned to any account by the natives.

The most remarkable animal in this country, in proportion to its size, is the tapir, (tapirus terrestris,) which is found in great numbers in the upper course of the rivers Chicapa and Ostuta, as well as all the wild spots of the Sierra affording good pasture and an

abundant supply of fresh water. The flesh of this animal has an agreeable taste.

In the upper Ostuta there are also considerable herds of wild cattle, proceding no doubt from those which escaped into the woods from the old estates called Frailescas.

In the river just mentioned, as well as in all the others above named, there are a great number of martens of a particularly beautiful species.

In this part of the isthmus two kinds of the hog are very common, one called the wild boar throughout the republic, although it bears no resemblance to the animal known by this name in Europe; the other, the pecari, dicotyles tayacu of zoology. The male has on the back a gland that contains a fœtid humor, but its flesh, especially that of the female, is delicious food.

The woods are peopled with an immense number of monkeys of the genera lagothrix and ateles.

The deer, rabbits, and hares are innumerable in the isthmus, and the quantity of the latter which are constantly passing by the traveller in the plains of the southern coast is almost incredible.

From what has been already said of other animals, the abundance of the feathered tribe in these regions will naturally be inferred. Of these the crax alector, improperly called pheasant; the wild turkey (meleagris gallo pavo;) the chachalaca (ortalida garrula;) the partridge, the quail, the wild pigeon, and ducks of various kinds are particularly remarkable.

Among the birds the most deserving of attention for their beautiful plumage are those of the parrot kind, the toucan, and on the shores of the lagoons, the platalea ajaja, of a beautiful rose color.

Among the reptiles are found the guana, the flesh of which is considered by the natives delicate food. Unfortunately, too, there are also the most dangerous kind of serpents, such as the rattlesnake, (crotalus horridus,) the coral colored, and many others.

The lagoons, the rivers, and the ocean contain a variety and quantity of fish truly astonishing, as well as a considerable number of tortoises of various kinds. The divers of other coasts are in the habit of coming to the neighborhood of the Morro in quest of the valuable tortoise-shell, coral, and pearl, which these coasts contain in abundance. The natives of Tehuantepec find also near the Morro a kind of purple shell-fish, from which they extract a substance which is much in use among them as a dye. The monstrous alligator inhabits the lakes near the coast, contaminating with its unseemly presence the beauty of the scenery.

Lastly, of the natural products of the country, those yielded by the insects of the isthmus ought not to be overlooked. The most remarkable of these are the honey and wax with which the bees fill the woods, and the enormous bags of raw silk suspended by small worms from the branches of trees which the women of Tehuantepec turn to no small account.

Industry.

Were it not already an established axiom that the want of communication renders totally useless the territorial wealth of a country, the following account of the scanty and miserable annual produce due to the industry of the natives of the isthmus, compared with the exuberance of their natural productions, would be sufficient to prove it.

A road which extended from the coast of the Pacific to the navigable portion of the Cotazacoalcos, opening a communication between the two seas, has been twice established, and both have been periods of prosperity for the isthmus. This took place at the time of the conquest, and subsequently towards the end of the eighteenth century. At present scarcely any vestige remains of these ancient roads, and the isthmus lies in a waste and unproductive inertness. The following observations will show the actual state of their scanty resources.

Agriculture.

Table 2, due to the zeal of Don Pedro de Garay, exhibits the private landed property existing in the southern part of the isthmus.

"The estates," says Señor Garay, "which more particularly deserve attention, both for their extent and for the improvement of which they are susceptible, are those called *Haciendas Marquesanas*, from being entailed in favor of Hernan Cortes, Marquis del Valle, whose descendants enjoyed them up to a late period."

These estates are situated between the Barrio de la Soledad and the course of the rivers Malatengo and Chichihua, the stream of Zopiluapa, and the river del Cazadero. At present they belong to Messrs. Guergue and Maqueo, merchants of Oajaca, the former a Spaniard, and the latter an Italian.

The produce most in requisition with all the inhabitants of the isthmus, and in general of the whole republic, is maize, of which they make the *tortillas*, (small cake,) and which is their principal food; but the want of roads to facilitate its conveyance causes the inhabitants to grow only as much as they require for their own consumption, which is little enough, as, besides their natural frugality, the woods and rivers furnish them with an abundance of provisions.

The Indians of Guichicovi are the most active cultivators of maize; but the harvest, which in proportion to the quantity sown they reap in great abundance, is due much more to the fertility of the soil than to the intelligence or art of the cultivator. Tehuantepec and San Miguel are the only places in the isthmus where I have seen the maize plantations artificially watered, a proof that these two towns are somewhat more advanced in agriculture.

Some attention is also paid in this part of the isthmus to the cultivation of the sugar cane. There is a sugar factory in the neighborhood of Chihuitan, belonging to Messrs. H. Gobert and Olivier Gourjon, the former a German, and the latter a Frenchman.

According to the note taken by Don Pedro de Garay, this establishment, founded but a few years ago, can yield 50,000 kilogrammes of sugar, representing there a value of 45,000 francs, and 20,000 francs more for the brandy distilled from the molasses.

"Should the plantation and cultivation of the sugar cane (adds Señor Garay) receive the encouragement of which they are susceptible, this estate alone might supply the sugar requisite for the consumption of the whole district of Tehuantepec, which may at present be considered to amount to about 125 thousand kilogrammes."

Señor Garay observes that these are not the only plantations of sugar cane existing in the isthmus, and that the Indians of Guichicovi, especially, manufacture an impure sugar, used for the confection of brandy. This spirit is chiefly distilled at Tehuantepec, Juchitan, and Itztaltepec. Señor Garay estimates at 40,000 francs the total value of the brandy consumed in the southern part of the isthmus, to which he thinks ought to be added 30,000 francs for the *mescal*, a kind of brandy extracted in those places from the leaves of the American agave.

The most important agricultural produce in this part of the country is that resulting from the cultivation of indigo. Upon this point the secretary of the commission remarks:

"It is of such excellent quality as to be in request in all parts of the republic, and it is also exported abroad. An average crop will produce about 60,000 kilogrammes, representing a value of 600,000 francs. Its cultivation demands scarcely any attention, as the plant continues to be productive for the long period of three years. It has been often calculated that the expense of the cultivation of indigo in fruitful years, before it acquires its perfect growth, does not exceed 3 75 francs per kilogramme, whilst its value is never less than 10 francs.

"The settlements where this important cultivation is most flourishing are Juchitan, Itztaltepec, San Geronimo, Chihuitan, and generally throughout the whole districts of Tehuantepec."

After the indigo, the *iztle* and *pita* are among the most considerable productions, but I am without sufficient accurate information to venture an assertion respecting their true value, which is also the case respecting tobacco, annotto, wax, honey, and wild silk.

It is well known that the cochineal insect of these parts is the best in quality of any known, but its cultivation is almost entirely abandoned. Gum is so abundant that, according to the assertion of Señor Garay, the neighborhood of Juchitan alone will furnish 300,000 kilogrammes, each valued at about 0.25 francs.

Cattle.

Formerly numerous herds of cattle grazed in the southern division of the isthmus. Don Tadeo Ortiz says that, in the Frailescas estates alone, there were more than 30,000 head of horned cattle, besides a considerable quantity of horses. At present there are

not more than 1,500 of the former, and only a few hundreds of the latter.

Table No. 2 shows that the whole of the black cattle in this district amounts to 44,000 head, one-fourth of this number occupying the Marquesanas estates. The only utility derived from this cattle is almost exclusively limited to the use of its flesh and the sale of hides. It will easily be surmised that the consumption cannot be very considerable, since the population is so scanty and poor.

To complete this brief notice respecting the cattle, I will only add that, according to the memoranda of the secretary of the commission, the number of horses and mules may be estimated at 25,000, and that of the sheep at 1,500. No use whatever is made of the hides.

Fisheries.

The shrimp and dry fish prepared by the Huaves in the four villages of the coast, besides providing for the consumption of the inhabitants of the country, are sent in rather large quantities to Oajaca, and other points of the republic, but in this also I am without sufficient information to form a correct estimate of their value.

The tortoise-shell, coral, and pearl are of no utility whatever to the inhabitants of the isthmus, who never apply themselves to this kind of fishery.

Salt pits.

Upon this point also I cannot do better than extract the observations of the secretary of the commission, who after remarking upon the great importance which these salt pits might acquire, says:

"They are so numerous, that it would be difficult to determine the quantity of salt they yield; but from a proximate calculation, made with the assistance of some well informed persons, their produce may be estimated during the period when they were worked on account of the government at 35,000 kilogrammes; and it may be asserted with truth that the whole of their produce was not turned to account, since it is no exaggeration to say that from Huamelula to Tonala the entire intervening space is one continued salt mine.

"This salt is highly esteemed in various parts of the republic, both for its purity and its whiteness. The principal consumption takes place in the departments of Chiapas and Oajaca, the annual produce derived from it being about 200,000 francs. This salt was sold at the public administration of Tehuantepec at six francs per kilogramme, and somewhat less when sold in the works themselves. Its cost to the government was not more than 1 franc 25 cents for every 100 kilogrammes; since being of spontaneous formation, and not requiring any operation whatever, the expense was limited to the mere carriage from the works to the place of deposite."

Manufactures.

Those for which the inhabitants of the isthmus are more distinguished are leather-dressing and harness-making. At Tehuantepec and Juchitan doe-skins are prepared of any color required, and with a degree of skill which entitles them to the high repute they have attained. Other kinds of skin are also tanned there, and the sole-leather and dressed ox-hides of Tehuantepec are much esteemed. Shoes and saddles manufactured of them are occasionally sent to Guatemela and the interior of the republic.

Finally, another produce of the industry of the inhabitants of the isthmus consists in cotton stuff, woven with an admirable degree of fineness, considering the imperfection of the looms employed for its manufacture. These goods are also to be reckoned among the few articles of commerce.

Antiquities.

The southern division of the isthmus is particularly rich in antiquarian remains.

1. The road which leads from Mexico to Tehuantepec, on arriving in front of the Mistequilla, crosses a defile overhung by an eminence, called in the Zapoteco language, *Guiengola*, which means large stone. In the historical manuscript, which I have often quoted, it is observed that when king Cosijoeza began his struggle for dominion against the emperor Montezuma, he made on this hill, which he had previously fortified and well supplied with arms, ammunition, and provision, the brilliant defence which secured to him the sovereignty of these lands. It appears that in those times there were in the hill several springs of water, of which not the slightest trace now remains; but there are still to be seen, as I have been informed, splendid ruins of fortifications and vast barracks. There is no doubt whatever of the existence of these ruins, and the commission intended to have visited them had not other duties of more importance prevented it.

2. The hill of Coscomate, near Zanatepec, is also called hill of *the sun and moon*, from two colossal representations of these heavenly bodies carved in the solid rock, which are described as illustrated by an inscription in unknown characters. The name of Cerro del Venado, (deer hill,) is likewise attributed to an effigy of this animal being hewn out of one of the rocks.

3. The old men who accompanied me in one of my expeditions to the upper Ostuta, pointed out to me the situation of a valley about nine miles east of the Cerro del Venado, where they found the remains of a large town with buildings of stone. None of these spots were visited by the commission.

4. Any object which has been shaped by nature into a fantastic form is considered as *enchanted* by the inhabitants of the isthmus. Thus they designate with this epithet the caves of the Cerro del Convento and of the upper Chicapa, the Cerro Atravesado, the

problematic lake of Ostuta, and, above all, the island of Monapostiac, more generally known as the *Enchanted Hill*.

In the manuscript just alluded to, it is mentioned that king Cosijopi, at the beginning of his reign, offered up a solemn sacrifice to the greatest idol of the Zapotecos, called the *Heart of the Kingdom*, which was placed in this island.

From the commencement of our operations, I fixed upon the highest point of the Monapostiac as the vertex of one of the first triangles of the trigonometrical net. The intelligence of our determination to proceed thither and fix upon it a signal, caused the greatest astonishment and terror among the natives. A furious storm was sure to rise on our nearing the island, and our loss was considered inevitable.

Nor is it to be wondered at that these ignorant people should entertain superstitous ideas respecting this island, since the formation of it naturally excites considerable wonder, even in the minds of the well informed. From the summit to the base, which lies in the waters of the lake, it is composed of huge blocks of green sienitic stone, confusedly thrown one upon another, as if a heap of rubbish; and when these stones are struck together they emit a sound not unlike that of a large bell. I have in the geological section ventured an hypothesis upon the singular structure of this island, supposing that it came out in a state, if not of positive fusion, at least one of incandescence, and that it broke into pieces by the uneven contraction of the matter caused by the surface, from being exposed to the air, cooling sooner than the centre. The movement of the successive strata might afterwards have displaced the upper fragments, giving to the whole its present aspect. I may be mistaken in this supposition; but it is, however, that which naturally occurs on seeing the Monapostiac, and its irregular formation appears difficult of explanation in any other way.

The idols which were found in this island are of terracota, and have been deposited in the national museum of Mexico. Their character is very different from those made by the Aztecs, and some of them are not without artistical merit. Unfortunately, during their removal, they were broken in such a manner as to prevent the possibility of joining the fragments.

We were assured that the island of Tilema possesses also several objects of archæological interest, and that in the island of Arrianjianbaj, which signifies old city, the remains of an abandoned small town are still to be seen. These two points have not been visited by the commisssion.

NORTHERN DIVISION OF THE ISTHMUS.

Department of Vera Cruz.

This portion of the isthmus belongs to the district of Acayucam, which was formerly one of the most densely populated of the Mexican empire.

The commission having limited their operations in these parts to

the exploration of the river Coatzacoalcos throughout its course, can offer but little statistical information as the result of their own observations; some data, however, which I possess, and on which the most implicit reliance can be placed, will enable me to supply this deficiency.

Besides the information afforded by the writings of Don Tadeo Ortiz, the government of Vera Cruz published, in 1831, the statistics of their own territory, and Don José M. Iglesias edited, with accuracy and tact, the portion relating to the district of Acayucam. Since 1831, the condition of this country has considerably improved, as may be inferred by the buildings now in progress in the chief town of the district, as well as by the flourishing plantations of cotton and tobacco, not one of which existed at that time, but which have since acquired some importance. Adhering, however, to my determination of asserting only that which I can in some way prove, and not being aware that there are any other documents published more recently, I shall extract from them the necessary information.

Our topographical knowledge of these regions, where forests of immense extent and almost impenetrable thickness rende rthe work of exploration difficult, is necessarily very limited. It is, however particularly characterized by the course of the Coatzacoalcos, with which we are already acquainted; and we know likewise, that the ground on both sides of this river is watered by streams of scarcely less importance, the waters of which might be advantageously employed to facilitate the communication between this fertile territory and the adjacent districts.

Don Tadeo Ortiz, comparing the Coatzacoalcos with the rivers Mississippi, Bravo, Panuco, Papaloapan, (now Alvarado,) Tabasco, Magdalena, and Orinoco, shows the preference to which it is entitled, particularly as regards their respective bars. He asserts seveeral times that the waters of the Coatzacoalcos are always clear, "even in the greatest floods;" to which ought to be added the additional advantage of there being no logs of timber to obstruct its course, although it runs through a continuous forest; this favorable circumstance being undoubtedly owing to the gentle current and the tenacity of its banks.

After the river Coatzacoalcos, the next in importance is the Uspanapan, which, according to Ortiz, "runs through a pleasant and picturesque region of temperate climate, and once thickly popuated." This region, he thinks, is that which Cortes and Clavijero called Chimatlan and Quiexula.

"It is very probable," says Ortiz, "that this district, which is now deserted, may afford a short and regular transit to the beautiful plains in the centre of the isthmus, as the conquerors penetrated through it into the upper Tabasco and Guatemala."

Besides the Uspanapan, the rivers Coahuapa, Coachapa, San Antonio, Tancochapa, and Zanapa, water also the plains lying on the right of the Coatzacoalcos; all of them are more or less navigable, and the latter discharges itself into the Atlantic, about 40 kilometres eastward of the mouth of the Coatzacoalcos, through the bar of Toneladas, which the mariners of old mention in their writings

as a frequented port, and which is well worthy the attention of modern navigators.

The territory west of the Coatzacoalcos is also intersected by mighty rivers, among which the Jaltepec and the San Juan are the most remarkable. The former, which, as we have seen, joins the Coatzacoalcos, runs through a country remarkable for its magnificent vegetation; and Ortiz is of opinion that a great portion of its course might be navigable for steamers. The latter falls into the Atlantic by Alvarado, and the Acayucans follow its course, when going to Vera Cruz, between which port and the Coatzacoalcos it is asserted that a water communication might very easily be established.

In the district of Acayucam there are sixteen municipalities, but I do not exactly know the number of political divisions, these being now different to those of 1831.

The town of Acayucam, situated at about 17° 50' 30" north latitude, and 0° 5' 45" east of the meridian of Juchitan, is the head of the district of the same name, and the residence of a prefect, a judge of first instance, a military commander, and a parish clergyman.

Acayucam, before the conquest, was the court of one of the most powerful caziques among the tributaries of the empire of Mexico. Cortes, however, diminished its importance by forming the town of Espiritu Santo, which, during one hundred and thirty-six years, was the capital of the province; but the latter having subsequently been abandoned by its inhabitants in consequence of the frequent pillages to which it was subjected about the middle of the seventeenth century, Acayucam recovered a small portion of its former importance.

The district of Acayucam, as regards the ecclesiastical division, belongs to the diocese of Oajaca, like the rest of the isthmus, and has three parish churches and a vicarage.

Inhabitants.

The tables formed upon the data afforded by the statistics of Senor Iglesias, show that the population of this district, even if we suppose it not to exceed that of 1831, amounts to 21,000 inhabitants, divided into *Europeans*, *Indians*, and *Mestizos*, or mongrels.

The *Europeans* are a limited number, and chiefly occupy themselves in commerce and the public administration of affairs.

The *Indians* constitute more than three-fourths of the whole population, and apply themselves to agriculture. These Indians are almost all Mexicans, and although very ignorant and superstitious, do not evince any perverse inclinations. Their manners and customs are somewhat loose; they are little inclined to work, but their natural docility leads me to believe that it would not be difficult to make them industrious and useful. They have not the disagreeable appearance of the Mijes and Soques; and if they are not to be compared to the Zapotecos, the difference is chiefly owing to the excessive use of strong spirits, as well as the habit acquired

from childhood of eating earth, which deforms them, and imparts to their complexion a sickly hue.

Jaltipan is celebrated among the Indian villages of this territory for having been the birth-place of the enchanting Malinche, (Doña Marina,) who, by her fidelity and sagacity, materially assisted the victories of Cortes.

The women of this village are famed, and not undeservedly, as the handsomest throughout the district; but, in common with the rest of their sex in the isthmus, they cannot boast of very strict ideas of propriety. It is also said that the male population, instead of watching them with a jealous eye, carry their ideas of hospitality to a very peculiar length.

A singular circumstance, deserving the attention of the etnologist, is the existence of a race of dumb people, of which there are numerous families in Jaltipan. However strange this may appear, it is nevertheless certain, and the *Rancho de los mudos*, (settlement of the dumb,) established a few years since near the lower part of the island of Tacamichapa, owes its designation to the fact that the individuals are all dumb who inhabit the three or four houses which form this settlement.

The *Mestizos* are a mixed race of Europeans and Indians. They are in general more rational and industrious than the latter; but, like them, indulge in intemperate habits, and are much more turbulent. The number of Mestizos exceeds that of the Europeans.

Climate.

The climate of this part of the isthmus is damp, but its temperature being generally low, compared not only with the southern division of the isthmus but even with the other coasts of the Atlantic, it is by no means unhealthy, as its position would lead one to suppose. The centigrade thermometer does not reach in these regions more than thirty degrees; the most prevalent diseases are intermittent fevers, but no instances have hitherto been known of the yellow fever, endemic in other countries.

About the year 1830, three expeditions of Europeans were sent to the Coatzacoalcos for the purpose of colonization. By a most unaccountable want of foresight the unfortunate colonists were abandoned from the moment of their arrival, and were left without provisions, without shelter against the inclemencies of the season, and without assistance of any kind. Although everything seemed calculated to favor the development and progress of an epidemic, no disease of this kind appeared among them, for those who died perished more from misery and famine than from any other cause.

By means of considerable felling of timber, and the cultivation of the ground, the climate of this portion of the isthmus would no doubt be considerably improved, as it would remove the clouds of insects which at present render a residence here to a great degree uncomfortable.

NATURAL PRODUCTIONS.

Minerals.

I am unable to assert anything positively respecting the mineral formations of this district. Information purely traditional suppose the existence of rich mines of precious metals at the heads of the rivers Jaltepec, Uspanapan, &c.

In a statistical account of Don José Maria Iglesias, mention is made of two mineral veins in the neighborhood of the village of Joteapa, which were denounced in 1597 as being of silver, but the exact nature of which in reality is not yet known. It is stated in the same work, that the calcareous rocks found in several parts of this territory might furnish excellent building materials; that in the settlement of *los Quemados* there is beautiful alabaster, and near Jaltipan, gypsum of excellent quality. Lastly, it is stated that in the villages of Sayultepec and Moloacan there are fountains of petroleum; in the last mentioned place Almagres and springs of sulphureous water, and in the village of Chinameca a fountain of mineral waters, without mentioning its qualities.

I have been fortunate enough to be the first to find in the Mexican republic mines of coals of a superior quality, which I have already legally denounced, and the circumstance of their being situated in the neighborhood of a great river would render the conveyance of their produce very easy.

I have seen no indication in the isthmus of the existence of this valuable fossil; but certain analogies of geological formation suggest, in my opinion, the probability of its being found in a particular spot between Tehuantepec and Oajaca. I did not wish to omit these observations, on account of the importance of the subject in connection with our main object.

Vegetable Productions.

All the plants which I have mentioned, speaking of the southern division of the isthmus, are also found in the northern, but with a profusion incomparably greater. The luxuriance and majestic appearance of the forests of the Coatzacoalcos are beyond all description; and, as Don Tadeo Ortiz well observed, they exhibit "a truly monstrous vegetation, of which ocular inspection alone can give an adequate idea."

The first impression produced, in the minds of those who visit them, is the immense advantages which a prudent speculator might derive from the proper use of their rich produce.

"These forests," says Ortiz, "might furnish all the mahogany and other fine woods required in the United States and throughout Europe, at prices considerably less than those of other parts of America, where these woods are certainly neither so abundant nor of the gigantic size of three metres in width and from fifteen to twenty in height."

Don José Maria Iglesias, speaking on the same subject, says: "They abound (the forests) with the finest and most precious woods, but especially mahogany and cedar, which, without hyperbole, might well supply the whole of Europe."

Finally, Don Pedro de Garay says, in his memoir: "There are seen on every side dye woods and timber, which will in time acquire their true value, and will exceed, without doubt, the cost of any speculation."

In almost all the rivers, and especially in the Jaltepec and Uspanapan, the pine is found in the upper part of their course; then comes the majestic oak, and in the lower part the most precious woods. Among those used in construction, the cedar, the sapota, the oak, the yellow-wood, the ebony, the *javicue*, *macayo*, and above all the *paqui*, (iron-wood,) which from its extreme hardness is also called there *quiebra hacha*, (break-axe.)

Along the whole coast of the Atlantic, the tree which produces the kind of pepper known by the name of myrtle (myrtus pimenta) is found; and, according to the calculations of Señor Ortiz, this fruit might be gathered annually to an amount of 250,000 francs.

In various parts, but particularly in the neighborhood of Jaltipan, I have observed the siphonia cahuca, from which the caoutchouc, or India rubber, is obtained. In other spots the cassia is also very common. Fruit trees are almost innumerable: the sapotas of various kinds, the lemon, the orange, and the wild chocolate tree, being remarkable among them, as well as two kinds of vine. The vanilla, the indigo plant, and the sarsaparilla, are also very plentiful.

In the neighborhood of Mina-titlan I found two species of the sensitive plant, one of which is the common mimosa pudica so generally known, and the other grows on a bush upwards of two metres in height. It would be useless to add that the most beautiful flowers are everywhere to be found, and that a great quantity of gums, resins and balsams form a part of the rich produce of this magnificent vegetation.

Animals.

It will be easily conjectured that forests so extensive as those to which we have been alluding, must be inhabited by a considerable number of animals. The quantity of wild animals which infest these territories is almost innumerable, particularly in the neighborhood of the settlement of Teposapa, according to Senor Iglesias. The tapirs, the deer, the rabbits, &c., are still more abundant; but surpassing all in number, is the tribe of monkeys, that delight in a plentiful harvest from the constant profusion of fruit by which they are surrounded. Many of these belong to the species before named when speaking of the southern division of the isthmus, while others are peculiar to the woods of the Coatzacoalcos, among which are some nocturnal species, and the stentor ursinus, that frequently breaks the silence of the forest with his shrill and powerful cries, so loud, indeed, that, judging only by its power, any one

not seeing the insignificant little animal from which it emanates, would suppose it to be of considerable size.

Following the course of the Coatzacoalcos, its banks are peopled with the so-called pheasants, the wild turkeys, the pigeons, partridges, ducks, and many other fowl, the flesh of which furnishes wholesome and delicious food. On the right bank of this river, near the Torno del Tepache, there will be found on the map a spot called the Matadero, (slaughter house,) a very appropriate name used to express the havoc which sportsmen occasionally make there with only a few minutes' delay.

The multitude of parrots which inhabit this country is really astonishing. There are also a great number of toucans, especially as the inhabitants of the isthmus include among these, without any distinction, the ramphastos and the pteroglossus. As regards other kinds of birds, their variety almost baffles calculation; some of them being remarkable for the beauty of their plumage, and others for the melody of their song.

The waters of this district abound in excellent fish. In the lower part of the Coatzacoalcos the manatus, called, from its size, the sea-cow, is frequently found. A peculiar kind of fresh water tortoise deposite on the banks of these rivers great quantities of eggs, quite different from those of the sea tortoise, and very similar to those of the hen, both in appearance and flavor.

The coasts of the Atlantic belonging to the isthmus are celebrated for the abundance of tortoise shell they contain, the fishery of which gives employment to the industry of the inhabitants of Campeachy.

The guanas, the flesh of which is a delicious morsel to the natives of the isthmus, differ in the southern and northern divisions. In the former they inhabit the dry and barren spots, and are of a dusky brown color, whilst those of the Coatzacoalcos are of a light green, variegated in the males with beautiful red spots.

This district, in common with the southern, is, unfortunately, not free from the venemous reptiles which only disappear in the thickly populated regions. The credulity of the natives ascribe to many plants the merit of neutralizing the dangerous effect of the bite of the most poisonous of serpents, but the great number of these remedies causes me to doubt their efficacy. The only plan adopted which appears to me effective, if applied in time, is to extract from the wound by means of suction the venom and a part of the poisoned blood, an operation which is performed by many of the Indians, who, on this account, are called suckers.

In the oak thickets of this district there are vast quantities of bags of wild silk, and everywhere wax and honey in abundance.

Industry.

The picture of the state of native industry presented in this part of the isthmus is even more sad and discouraging than it was in the southern division. Agriculture, however, which in 1831 might be considered almost nugatory, has made some progress of late years,

and several of the inhabitants have applied themselves to the cultivation of cotton and tobacco, although I am unacquainted with the respective amount of these products.

The cotton grown here appears to be of excellent quality, and also the tobacco, which is especially cultivated in the territory of Jaltipan, where the natives understand well its management. The grains more generally sown are maize, beans, and rice, but only in sufficient quantity for home consumption.

The soil is so fruitful that both Don Tadeo Ortiz and Don José Maria Iglesias assert, that the efforts of the cultivator are in some places rewarded with five annual crops of maize; each of these crops is distinguished by a different name, being respectively called tornamil, tepachole, temporal, tepeta, and etopil. Senor Ortiz, speaking with enthusiasm of this fertility, says: "that which most particularly characterizes this privileged region, however, is the singular fact that one single sowing of rice will yield successively two large crops without the slightest additional labor, as I had an opportunity of observing in the rancho de Gavilanes, situated in the strand between the rivers Coatzacoalcos and Toneladas."

The sugar cane, coffee and cocoa prosper throughout this district, and are cultivated in the neighborhood of almost all the settlements, although in very limited quantities. On the Coatzacoalcos, the only plantation of any importance is one of coffee and cocoa, which an European settler established a few years ago, near Hidalgo-titlan, on the banks of this river, opposite to this village.

The iztle is chiefly cultivated at Jaltipan, Soconusco, Tejistepec, Oteapa, Ishuatlan, and Moloacan. In 1831, Senor Iglesias numbered 1,221 iztle plantations, the produce of which, generally sent to Vera Cruz, he estimated at upwards of 100,000 francs.

In Mina-titlan there is a brandy distillery, the most considerable in the district; but almost everywhere, and even in the ranchos or small settlements, this pernicious liquor is distilled by means of an alembic of baked earth, the rude instrument of primeval industry.

As regards mechanical arts, it may be said that none whatever exist in this district. In the statistical accounts of 1831, the only statement I find upon the subject is, that the natives of Jaltipan occasionally tan a few hides which they use for the manufacture of saddles.

Observation.

It may be well to observe here that the population and resources of the isthmus are more considerable than would appear from the foregoing statement.

The whole of the resources and population of the district of Tehuantepec ought to have been included in the southern division. I have, however, only referred to that portion included within the topographical limits of the isthmus.

With regard to the district of Acayucam, I have already said that its agriculture has received a remarkable impulse since 1831, but I have omitted to make mention of the quantity of cattle belonging to its towns, estates, or ranchos, whenever my assertions

could not have rested upon positive information. It is therefore evident that the resources of the isthmus of Tehuantepec are underrated in the preceding statistical notice.—See appendix C.

Advantages of an oceanic communication through the American isthmus, and preference which ought to be given to the territory of Tehuantepec over those of Panama and Nicaragua.

Christopher Columbus was the first to estimate the great importance to the whole world of a maritime communication across the American isthmus. The advantages that would result from it are indeed so evident, and the lucid observations of Humboldt, which prove its importance, are so well known and appreciated, that it appears to me needless to repeat them in this place; I will, therefore, only add one other remark which I have not hitherto met with, but which will give them a more extensive application.

It is generally acknowledged that, if the communication be once effected, all the vessels, which, from their ultimate destination, are now compelled to double Cape Horn, would, of course, pursue their route through the isthmus. It is also admitted that, in consequence of the favorable winds and currents, this voyage would be preferred to that round the Cape of Good Hope, even for vessels proceeding from Europe to China and Japan; but it is believed that it would be by no means equally convenient for their return from China to Europe, still less for the voyages to and from the East Indies.

If, in order to solve this problemn, we were to consider only the positive distance that separates the extreme points of these navigations, nothing certainly would be gained in the latter case by following the course through the isthmus in preference to that at present adopted round the Cape of Good Hope; but if, on the one hand, we take into consideration the difficulties and dangers to be encountered in this navigation, and, on the other, the advantages which might be derived from making port half way, in a country undoubtedly destined by its natural wealth to the highest future prosperity, as well as the additional and incalculable advantage of being enabled to estimate beforehand the probable length of the voyage, it cannot be doubted for an instant that the course through the isthmus ought at all times to be preferred. This opinion, which may now appear doubtful, will certainly cease to be so on that day, probably not far distant, when the progress of mechanical science will enable the mariner to disregard altogether the uncertainty of the wind, and when that route will be deemed the best which offers the safest navigation.

The American isthmus extends from the Darien gulf, where it is united to South America, as far as Tehuantepec, where North America may be said to commence. Different parts of this isthmus have appeared to offer advantages in their topographical form, and have invited attention to their fitness for the desired communica-

tion. It was, however, soon observed that only three of these localities were worthy of consideration; namely, those which, from the principal towns in their territory, are designated, by way of distinction, isthmus of Panama, of Nicaragua, and of Tehuantepec.

In respect to the first of these named places the distance between the two oceans is only 65 kilometres. It is impossible, therefore, to examine the map of the American isthmus without being inclined to consider this point as the most eligible. The distance that divides the two seas is greater at Nicaragua, namely, 150 kilometres, but being intersected by a lake of vast dimensions, this point would also appear to offer considerable advantages. Lastly, the territory of Tehuantepec, forming a continued line of 220 kilometres, is that which upon a superficial examination presents the greatest obstacles for the accomplishment of the object contemplated.

However, notwithstanding these appearances, as a greater or less distance is not the only circumstance to be considered, it precisely happens in the three above mentioned instances that the practicability of the work is in an inverse ratio to the shortness of the distance; and thus, while in the present state of our knowledge its execution is apparently impossible at Panama, and attended with immense difficulties at Nicaragua, we find it practicable and easy at Tehuantepec.

The isthmus of Panama has been, from the time of the conquest, the object of the most diligent investigations, and it is an error to suppose that the Spanish government never paid any attention to this subject. Unfortunately not one of the explorations which were practised offered any satisfactory result, and the silence relative to this subject, which was maintained by the celebrated astronomers who, at the close of the last century, resided for some time in these regions, is the greatest proof that they had no favorable tidings to communicate to the world upon this important matter.

The form and topographical aspect of a country so limited in extent, and which had attracted a considerable share of public attention, could not possibly have remained unknown during three centuries, whilst it is very evident that there are not in either of the two opposite coasts any natural harbors to which the extremities of a canal could be directed. It has been lately asserted that all difficulties had disappeared, and that it would be as easy to construct a canal in Panama as it would be in Holland. The more recent report, however, of intelligent engineers purposely sent thither to ascertain the facts, seems on the contrary to point out the great obstacles which the territory presents to an enterprise of this nature; but even supposing that the topographical aspect of the ground offered no difficulty whatever, there are others quite sufficient to render it impracticable, and which unfortunately cannot be remedied.

Monsieur Michel Chevalier, while examining the circumstances which ought to be kept in view in selecting the most appropriate

place for an oceanic communication, very justly observes that one of the most important is its salubrity. He says:

"However great might be the saving of time effected by steering through the isthmus, it would always be shunned by vessels if it were to prove a charnel-house."

The climate of the isthmus of Panama is acknowledged to be dangerous, a fact confirmed by the accounts of Humboldt and other writers. The fear of its unhealthiness was one of the causes that prevented the assembling of Congress there, after the emancipation of the States of Spanish America had been convened, in order to establish a system of general policy suited to the interests of the American nations. The same fear prevented the engineers, Lloyd and Falmarc, remaining in the isthmus a sufficient time to complete the labors of the exploration, which they undertook in 1827 and 1828 by order of General Bolivar, and in a succeeding expedition Lloyd lost his life. To this grievous cause is likewise to be ascribed the paucity of population and the want of the necessary means of existence in that isthmus, and as the climate does not permit the increase of the former, there is no possibility of augmenting the latter.

The isthmus of Panama is again being explored, but it has been lately estimated that even should the work be at all practicable its accomplishment would require the united efforts of the principal nations of the world, and an expenditure of at least 200 millions of francs.

The isthmus of Nicaragua possesses a fertile territory, a healthy climate, and is not deficient in population. Towards the north, the lake of Nicaragua communicates with the Atlantic by means of the mighty river St. John, and in the south only a small distance separates this lake from the coast of the Pacific. Thus the isthmus of Nicaragua seems to offer many advantages; but upon a more minute examination there appear many difficulties, and these of an almost insurmountable nature.

From the report published by command of the government of the state of Nicaragua in reference to the exploration of that isthmus, effected during the years 1837 and 1838 by Mr. J. Bailey, it seems that the course of the river St. John, with all its windings, is about 150 kilometres in length, six and a half of which are obstructed by four rapids, caused by banks of rock stretching across the whole width of the river. These obstacles and the long course of the river were considered such formidable impediments as to suggest the construction of a canal as an easier operation than that of rendering the river itself navigable.

Towards the south, a distance of nearly 28 kilometres between the lake and the Pacific, the territory is occupied by a chain of mountains which, although not very elevated, would occasion works of extraordinary magnitude. It would be necessary to excavate a considerable portion of it to a depth much greater than has been hitherto customary in works of this kind, and throughout more than five kilometres it would be indispensable to bore the mountains, and open a tunnel of sufficient dimensions to admit the large ves-

sels employed in transatlantic navigation. The possibility of attaining such an object is not a little doubtful, especially if the nucleus of the chain to be bored through consists, as well as the Andes of which it forms a part, of granite or ancient porphyry, as there is every reason to believe, notwithstanding the superficial experiments made by Bailey.

The port of St. John south, which would be sought to be reached on this side, is not adequate, from its small dimensions, to the required object; and moreover it appears that with the prevailing north and northeast winds its access is not only difficult but even dangerous.

It has been calculated that this undertaking would cost 150 millions of francs; but even this sum is probably much smaller than that which would be required.

The greater part of the distance which separates the two seas in the isthmus of Tehuantepec is occupied on the south by the lagoons and extensive plains, and on the north by the course of the Coatzacoalcos, so that the principal works to be executed would be comprised between latitude 16° 36′ and 17° 3′ north, including a space less than 50 kilometres in extent, wherein no excavation whatever exceeding the usual limits would be required.

As the object of our undertaking is a division canal, it was essential to convey to the point of division a requisite quantity of waters. Those of the river Chicapa and its confluents, husbanded with care, would alone have sufficed, but desirous of being prepared for the contingency of an extraordinary drought, we have sought out the means of obtaining an increase, and have so far succeeded in our object as not only to acquire the necessary body of water to feed the canal, but even a surplus quantity, which may be employed in increasing the currents of the rivers which it may be considered advisable to render navigable.

Our canal might have an excellent port at each of its extremities, and the materials for construction cannot be more abundant, superior in quality, or better distributed. A climate remarkable for its salubrity favors also the isthmus of Tehuantepec, and the departments of which it forms a part, number a population of seven hundred and fifty thousand inhabitants.

The admirable fertility of the soil, and the abundance of cattle and resources of all descriptions, would enable the vessels to renew their provisions at easy prices at the isthmus; therefore they might devote a greater portion of their hold to the storing of merchandise.

Besides these purely local advantages, the isthmus of Tehuantepec offers over those of Nicaragua and Panama others of a more general nature for navigation, affording to vessels proceeding from Europe or the United States, which, from their destination, have not to descend to more meridional latitudes, a communication more direct and through a more genial climate. On their return, vessels navigating the Pacific are now obliged to seek a northern latitude in order to escape the influence of the trade-winds, and for these also the course through the isthmus of Tehuantepec would be much

less circuitous. Lastly, the fresh but not dangerous north and north-easterly winds are common to the whole of the American isthmus, but Tehuantepec is not subject to the protracted calms which at some seasons of the year paralyse navigation at Panama.

Conclusion.

I may perhaps be allowed, in concluding this report, to express my ardent wishes that our labors in the isthmus may not be considered in reference only to whatever scientific merit they may possess, but as the means by which a most important fact has been ascertained, and which I have described in the preceding pages with the strictest conscientiousness. Should it be so, I am not without hopes that the great work which has been during three centuries so anxiously desired, and which the present commercial and political state of the world loudly demands, will at length be undertaken.

Many circumstances concur at the present moment highly conducive to its execution, and which ought to be made available.

The zealous interest which the Mexican government have taken in the matter is clearly demonstrated by the liberal concession made to the projector, and by the promptness with which all his applications have been favorably answered, as may be seen by comparing their dates with those of the corresponding decrees inserted in the following appendix.

The government of Mexico had undertaken to afford every protection and assistance in their power to the enterprise of Don José de Garay, and all the orders issued with this view were punctually fulfilled. The commission owe their most sincere acknowledgments to the local authorities of the isthmus, and now offer them through my medium. All the public officers vied with each other in affording every possible assistance to the commission, forwarding their object by means of circulars and orders to the inferior authorities, and readily furnishing all the information and particulars concerning their object which might be useful and interesting.

The inhabitants of that territory evinced the greatest desire for the realization of this great undertaking, and the commissioners were never compelled to make use of the armed force which had been placed at their disposal. This favorable disposition was never so apparent as during the act by which Don José de Garay was legally put in possession by order of the government of the territories granted to him; since, besides its having been effected with the greatest order, the proprietors of the adjacent lands, who were present, declared before the civil and judicial authorities, that they had no objections whatever to offer to the concessions, as they did not at all affect their property.

I cannot conclude these observations in a manner more pleasing to myself than by offering a public homage of my esteem to the gentlemen who accompanied me in these toilsome labors, which they so materially assisted.

In the short period of time during which Mr. De La Troupli-

niére took a part in the proceedings of the commission, he assisted with great zeal and attention.

In mentioning the name of Captain Gonzalez, the remembrance of his kind and gentle disposition, his indefatigable industry, and his talents and information, renders his early loss more lamentable. His delicate constitution gave him a presentiment of the shortness of his life. Towards the close of our labors in the isthmus his ailments had gradually increased, and four months after our return to Mexico he expired, leaving in the minds of his companions, who by my hand spread these few flowers over his grave, a lively remembrance of the feelings of sincere friendship with which he had inspired them.

Captain Robles, a gentleman of uncommon talent and information, has been the most active and intelligent colaborator of the commission in all kinds of operations, and gives great hopes to his country.

Señor Don Pedro de Garay, entrusted both with the secretaryship and with the administration of the expedition, acting in accordance with the instructions of the projector, provided with great taste and liberality for the comforts of the commissioners, as well as of their numerous retinue; besides which, the statistical section shows how much is due to his diligent investigations.

Lieutenant Guido lent also his willing assistance to the commission; and in one word, every one of the members composing it vied with each other in zeal for the fulfilment of their respective duties.

GAETANO MORO.

London, *June* 1, 1844.

A.

ASTRONOMICAL OBSERVATIONS.

TABLE No. 1.

Latitudes determined from astronomical observations.

Cupola of the church of Juchitan	16° 26′ 10′
Church of San Mateo Huazontlan del mar	16 12 47
Do....San Dionisio Tepehuazontlan	16 16 30
Do....San Juan Guichicovi	16 58 35
Do....Santa Maria Chimalapa	16 55 5
Paso de la Puerta	17 12 35
The strand on the right bank of the Coatzacoalcos below the mouth of the river de la Puerta (or Jumuapa)	17 21 5
South point of the island of Pedernal	17 27 45
Horqueta of the island of Tacamichapa	17 43 ..
Hidalgo-titlan	17 46 36
Mina-titlan	17 58 55

TABLE No. 2.

Geographical positions of the principal points of the triangulation.

The longitudes are reckoned from the meridian of Juchitan, which is 95° 9′ 37″.5 west of Greenwich.

	North Latitudes.	West Longitudes.
Cerro del Morro	16° 10′ 24″	7′ 57″
Xunirahui	16 12 40	13 10
Daniguibixo	16 14 36	7 16.5
Town of Huilotepec	16 14 54	7 42
Daniliesa (Cerro de la Cueva)	16 20 7	13 16
Daniguibedchi (Cerro del Tigre)	16 20 10	11 55
Parish church of Tehuantepec	16 20 16	12 24
Danigú or Camotepec	16 22 6	3 44
Church of Espinal	16 29 26	1 18
Do....Itztaltepec	16 30 27	1 57
Daniguiati	16 31 59.5	3 50
Cerro de Laollaga	16 32 32	12 51.5

	North Latitudes.	West Longitudes.
Church of San Gerónimo	16° 34′ 20″	4′ 29″
Do....de Chihuitan	16 35 44.5	8 16
Guiévichi	16 37 26	5 30
East summit of Huacamaya	16 42 28	1 15.5
Guiévixia	16 43 8	5 15
Pico del Almoloya	16 44 8	3 48
Church of Barrio	16 48 40	5 18
Do....Petapa	16 49 36	5 48
Do....Santo Domingo	16 49 45	7 5
		East Longitudes.
Church of San Mateo Huazontlan del mar	16 12 52.5	2′ 31″
Huachilaif	16 13 32	23 49
Church of Santa Maria del Mar	16 13 33	9 56.5
Summit of Baxmumbah	16 14 42	22 27
Do....Malumbiamlaif	16 14 59	24 31
Island of Tilema	16 15 30	7 33
Summit of Umalalang	16 16 39	11 13.5
Do....Mitiachuaxtoco (cerro de Santa Teresa)	16 17 10	13 22
Island of Monapostiac	16 20 34	7 13
Mitiacix or Cerro de la Iguana (island)	16 23 9	9 28
Tiactinayix	16 26 12	13 40
Cerro del Zopilote	16 26 31	31 36
Hacienda (estate) of the Venta de Chicapa	16 34 ..	12 14
Cerro del Lagartero	16 34 15.5	6 25
Summit of the Pié de Banco	16 34 41	20 29.5
Pico de Rinconchapa	16 37 13	11 14
Cerro de Paloblanco	16 38 17.5	13 51
Do..of Zapata	16 39 5	15 3
Summit of Piedra Parada	16 39 8	9 34
East peak of Cerro Prieto	16 39 41	2 3
The bare hill to S. S. E. of San Miguel Chimalapa	16 42 11	16 14
Summit of Paso Partida	16 42 17	11 28
Church of San Miguel Chimalapa	16 43 ..	16 33
Cerro del Convento	16 43 11	12 15
Peak of the Cerro Atravesado	16 43 12	30 8
Hacienda de Tarifa	16 43 31	8 57
Cerro de Albricias	16 44 21	15 49
Summit of Chichihua	16 44 34	12 57

TABLE No. 3.

Altitudes resulting from trigonometrical measurements.

	Heights above the level of the sea.
Summit of Daniguiati.....metres	274.5
Top of the cupola of the church of Juchitan	35.8
Basement of the same church	18

	Heights above the level of the sea.
Monapostiac.....metres	111
Umalalang.....	218
Daniguibixo.....	298
Guiévichí.....	416
East peak of Cerro Prieto.....	460
Guiévixia.....	598
Masahua (the middle summit).....	687
East summit of Huacamaya.....	775
Cerro de Laollaga.....	1,243
Palo Blanco.....	371
Estate of Tariía (the place of the habitations).....	208.5
Cerro de Piedra Parada.....	416
Do.... del Convento.....	446
Paso Partida.....	466
Masahuita.....	615
East summit of Masahua.....	696
Guiéxila.....	1,152
Peak of the Cerro Atravesado.....	1,529
The highest peak beyond it.....	2,343

TABLE No. 4.

Barometrical altitudes across the isthmus of Tehuantepec.

Umalalang.....metres	220
Mitiachnaxtoco.....	250
Daniguibixo.....	296
Venta de Chicapa (house at the estate).....	24
The river Chicapa, near the Rancho of la Puerto Vieja.....	83
The river Coatzacoalcos at the confluence of the Chimalapilla.....	119
Source of the stream Monetza.....	196
Petapa (the town house).....	204
The river Chicapa at the Ultimo Rancho.....	208
Farm of Chivela.....	210
Source of the river Almoloya.....	225
Santo Domingo (the town house).....	226
El Barrio (idem).....	232

Road from Santa Maria to San Miguel Chimalapa.

San Miguel Chimalapa (the town house).....	119
Rancho de la Cofradia.....	376
The stream running towards Chichihua and often traversed.....	275
Jacál del Ocotal.....	331

	Heights above the level of the sea.
Pass of the river of Chichihua.....metres	189
Pass of the river Escolapa	150
Jacal del Chocolate	326
Pass of the rivers del Milagro.....	84
Santa Maria Chimalapa (the town house).....	262
La Piedra del Viejo (the highest point between Santa Maria and the river)	296
The river del Corte at the confluence with the Chimalapilla.....	119
Tehuantepec.....	42
Zanatepec	50
San Gabriel Boca de Monte.....	50
San Juan Guichicovi (the town house)	249

TABLE No. 5.

Heights above the level of the sea of various places on the road from Tehuantepec to Puebla.

Tequisistlan.....metres	210
Rancho de las Vacas.....	745
San Bartolo Yautepec.....	870
Rancho Quemado.....	1,160
San Pedro Totolapan (the lowest part of the town.....	940
City of Oajaca.....	1,535
San Juan del Estado.....	1,680
Venta de Aragon	1,005
Cuicatlan.....	420
City of Tehuacan.....	1,575
Tiacotepec.....	1,905
Tepeaca	2,210

B.

GEOLOGY.

Catalogue of the geological collection formed in the isthmus of Tehuantepec, by the scientific commission entrusted with the exploration of the isthmus, and classified by Señor Don Andres del Rio.

SIERRA MADRE (PRINCIPAL CHAIN) AND NEIGHBORING HILLS.

Non-stratified rocks.

1. Milk quartz with a resino-vitrous lustre, and with the clivage of the rhomboedron very distinct, found near Chivela.
2. Decomposed granite near the Hacienda de Tarifa.
3. Granite found in the descent from the Portillo de Tarifa to the plain of the Venta de Chicapa.
4. Granite in pebbles in the upper course of the Coatzacoalcos.
5. Sienite, also in pebbles in the same spot.
6. Sienite at the foot of the Sierra, at little less than midway from Niltepec to Zanatepec.
7. Dioritic porphyry, or porphyritic greenstone, in the descent from Guichilona to Chihuitan.
8. Hypersthene rock found in the heights which surround the source of the stream Zopilaapa, cutting at intervals the calcareous rock.
9. Antique porphyry with crystals of felspar, tinted with chlorite and ferruginous clay from the hillock of Guichicovi.
10. Claystone porphyry from the summit of Cerro Atravesado.
11. Magnetic iron ore from the hills of Niltepec.

Stratified rocks.

12. Quartz rock found in the descent from the Portillo of Tarifa to the Rancho de la Agua Escondida.
13. Quartz of a chipped texture from the Paso del Ostuta, on the road to Zanatepec.
14. Quartz breccia, resting on the porphyry in the summit of the Cerro Atravesado.
15. Greenstone schist, hornblende rock of Lyell, peak of Guiévixia.
16. Grey-wacke schist; descent from Guichilona to Chihuitan.
17. Grey-wacke from the hills of Barrio.
18. Clay-slate, with the appearance of pearl-stone, resting on the quartz in the summit of the Cerro de Espinosa.
19. Clay-slate from the Portillo de Tarifa.
20. Clay slate found in the descent from the Portillo to the plains of the Venta.
21. Clay-slate, also with the appearance of pearl-stone on the summit of Paso Partida.

22. Clay-slate, in the gap between the above-named hill and that of Convento, on the road from Tarifa to San Miguel Chimalapa.
23. Clay-slate on a hill on the road from Tarifa to the Cienaguilla.
24. Greenstone schist found in the summit of Palo Blanco, mixed with fragments of quartz.
25. Greenstone schist in the pass of the Chicapa, near the Rancho of Puerta Vieja, on the road from the Venta to San Miguel.
26. Greenstone schist from the heights of the Upper Chicapa.
27. Greenstone schist changing to dioritic from the ascent to San Miguel Chimalapa.
28. Grey-wacke schist from the hills between the river Malatengo and the ancient estate of Xochiapa, on the road to Boca de Monte.
29. Talcose schist from the brow of the Sierra, in the ascent from Niltepec to the Cerro Atravesado.
30. Clay-slate from the foot of the Sierra, half way between Niltepec and Zanatepec.
31. *a* and *b* clay-slate and talcose schist from the banks of the Upper Ostuta.
32. Dolomite limestone found in a hillock at the foot of the hills of Laollaga.
33. Compact limestone, with veins of calcareous spar, found near the slate in the neighborhood of the Rancho del Zapotal.
34. Compact limestone which breaks into thin sheets in the descent from the Portillo to the plains of the Venta.
35. Calc tuff? from the same spot.
36. Compact limestone, and occasionally stinkstone, with veins of pearl-spar, from the Convento Chico.
37. Compact limestone of the Convento Grande: in one of the pieces there is a vein of calcareous spar, with fragments of diorite.
38. Quartzose sandstone from Daniguiati.
39. Argillaceous sandstone from Guievichi.
40. Sandstone, partly quartzose and partly argillaceous, near the estate of Chivela.
41. Sandstone schist from the table-land of Tarifa.
42. Sandstone from the foot of the small hill of Guibicia.
43. Sandstone from the Piédra Parada of Daningadchi.
44. Argillaceous sandstone from the foot of the Sierra, half way between Niltepec and Zanatepec.
45. Claystone which may change to jasper, on the road to Santa Maria Chimalapa, between the river Escolapa and the Chocolate.
46. Jasper found in pebbles in a strand of the Upper Coatzacoalcos.
47. Argillaceous stone in layers, little inclined, resting on the porphyry No. 9.
48. Guigosian stone.
49. Calcareous stone, with a circular design, found on the brow of the hills of Masahua, in the source of the stream Tolistoco.
50. Calcareous stone with cavities, resting upon another similar to that on the Cerro del Convento.
51. Variegated marls resting upon sandstone, on a hillock near the Hacienda de la Chivela.
52. Earthy marls, taken from a cavity in the calcareous rock in the ascent to the Portillo de la Chivela.
53. Common marl lying over the sandstone No. 38.
54. Calcareous breccia, on the road from the Venta to San Miguel.

49. Pearlstone breccia, found in loose fragments in the stream followed in going from Zanatepec to the Upper Ostuta.
56. Lamellar specular iron ore, from the neighborhood of Tarifa.

Banks of the river Coatzacoalcos.

57. Sandstone with a base of ferruginous clay, from above the confluence of the river Chimalapilla.
58. Greenstone rock, from a rapid a little before Angostura.
59. Metamorphic, or primary limestone, from the bank of the river a little below the mouth of the Malatengo.
60. Decomposed granite, from the great rapid below the old landing place of Mal Paso.
61. Clay from the small hills on the banks of the river in its lower course; *a* from the hill of Oajaqueña; *b* from that of Churriagao; *c* from that of Peñas Blancas.
62. Clay in layers, alternating with others of sand at Juchitan, 12 metres below the alluvial soil which covers the plain.
63. Calc tuff, from the margin of the fountain of Agua Caliente.

Hills near the lagoons and islands in the upper lagoon.

64. Grey-wacke, very finely grained, of the island of Iguana or Mitiacix.
65. Porphyry with basis of jasper, from the Mitiacxoconeu.
66. Porphyry with basis of argillaceous stone, from the summit of the hillock of Potrero.
67. Trachitic porphyry with small veins of calcedony, from Danigu.
68. Conglomerate of argillaceous base, from the small ravine of Chico Zapote or Endedchina, near to Danigu.
69. Jasper, from the small heights near those of the Potrero.
70. Dioritic porphyry, of the Manguixtiac.
71. Porphyry, from the summit of Umalalang.
72. Syenitic greenstone from the island of Monapostiac, in large separate pieces.
73. Stratified greenstone, from Natartiac or Cerro Prieto.
74. Fine grained granite in veins from the same hill, intersecting the former rock.
75. Greenstone from the same, resembling basalt, and taken from near the veins.
76. Greenstone with veins of tremolite, from the hill of Santa Teresa or Huaxtoco.
77. *a* Greenstone from the hill near to the Hacienda de Santa Teresa, intersected by veins of the granite *b*.
78. Conglomerate of fragments of greenstone from the brow of the Umalalang.
79. Argillaceous conglomerate, from the foot of the southern slope of the Maloxuet.
80. Prase, found under the slate in the same hill.
81. Grey-wacke, from the small hill of Umalpotate, at the foot of the former.

Sierra del Morro, and hills near Tehuantepec, Huilotepec, and San Francisco.

82. *a*, Ancient porphyry, with veins *b* of red iron and hidrate of iron, from the Cerro de la Cueva.
83. *a* and *b*, the same porphyry also, with veins from the Cerro del Morro.
84. Dioritic porphyry, intersected by veins of sienite *b*, from the Cerro del Tigre or Danigubedchi.

85. Finely-grained sienite, from the hills of San Diego.

86. Sienite and another rock, composed of quartz and albite, from the Huilotepec or Danguibixo.

87. Graphic granite of the hills of Huazontlan.

88. Veins of porphyry, altered by the fire of the hills of the Morro.

89. *a*, Dioritic porphyry of the Baxmumbah; *b*, granite from a fragment which intersects and partly covers the dioritic porphyry; *c*, new granite in veins which intersect the two previous rocks.

90. Granite and sienite from the Malnagirástias.

C.

STATISTICS.

TABLE No. 1.

Notice of the towns and villages in the southern division of the Isthmus of Tehuantepec, with their respective census, from the account furnished to Don Pedro de Garay by the prefect of that district.

Names of the towns and villages.	Census.
Tehuantepec—town	8,934
1. Santa Catalina Mistequilla	274
2. Tlacotepec	282
3. Santiago Laollaga	152
4. Santo Domingo Chichuitan	532
5. San Gerónimo	805
6. Itztaltepec	1,546
7. Espinal	504
8. Juchitan	4,567
9. Huilotepec	185
10. San Mateo del mar	1,500
11. Santa Maria del mar	148
12. San Dionisio del mar	888
13. San Francisco del mar	287
14. Zanatepec	336
15. Niltepec	626
16. Tapanatepec	321
17. San Miguel Chimalapa	318
18. Santa Maria Chimalapa	524
19. Santa Maria Petapa	1,447
20. Santo Domingo Petapa	626
21. Barrio de la Soledad	999
22. San Juan Guichicovi	5,000
23. San Gabriel Boca de Monte	71
	30,845

NOTE.—In the census of the above places, the number of inhabitants of the haciendas (estates) and ranchos (settlements) of their respective jurisdictions (table No. 2) has been included.

TABLE No. 2.

Notice of the principal haciendas and ranchos of the southern division of the isthmus of Tehuantepec, and of the number of horn cattle in each, calculated from the most authentic information which Don Pedro de Garay was able to obtain.

Names of the haciendas and ranchos.	Number of head of horn cattle.
Llano	....
Mal Paso	250
San Nicolas	1,000
Zuleta	300
Jicaras	1,000
Salazar	135
Niambiti	300
Cienaga	60
Guigochuni	50
Rio Grande	800
Trapiche de Santa Cruz	....
Nanches	150
Potrero de Santo Domingo	1,100
Barrio de Petapa	2,000
Guichilona	200
Chicapa, Tarifa, Chivela } Marquesanas	10,000
Trapiche de San Pablo	....
Espinal	3,000
Mesquital	200
Los Cerrillos	400
Paso Lagarto	700
Huasuntlan	80
Frailescas	1,480
Santa Bárbara	100
Lachilana	100
Comitancillo	120
Juchitan	12,620
San Francisco del mar	8,000
	44,135

TABLE No. 3.

Notice of the towns and villages of the northern division of the isthmus of Tehuantepec, their respective census and the number of head of cattle in each, according to the data furnished by the statistics of the State of Vera Cruz, published in 1831.

Names of the towns and villages.	Inhabitants.	Oxen.	Horses.	Mules.
San Martin Acayucam (villa)	1,902	287	249	50
1. San Andres Sayultepeque	1,206	.....	.....	.....
2. Tejistepeque	2,132	.....	88	.....
3. San Juan Oluta	659	.....	.....	.....
4. Santa Ana Soconusco	1,611	.....	46	.....
5. Jaltipan	1,302	88	238	.....
6. Casalicasque	1,595	303	52	.....
7. San Pedro Joteapa	1,665	16	40	.....
8. Santiago Mecayapa	736	.....	55	.....
9. Santa Maria Minsapam	773	.....	.....	.....
10. San Juan Chinameca	779	3,679	906	45
11. Oteapam	857	147	33	.....
12. San Cristobal Ishuatlan	497	500	21	.....
13. Santiago Moloacan	624	.....	.....	.....
14. Mimatitlan and neighboring ranchos	400	?	?	?
15. Hidalgotitlan and its ranchos	300	?	?	?
	17,038	5,000	1,728	95

TABLE No. 4.

Notice of the haciendas and rancherias in the northern division of the isthmus of Tehuantepec, with their census and number of head of cattle respectively, from the data furnished by the statistical account of the State of Vera Cruz, published in 1831.

Names.	Inhabitants.	Oxen.	Horses.	Mules.
Ranchería de Michapa	325	230	160	.....
Idem del Encinal	382	.....	35	.....
Rancherías { Coyote, Guellapam, Jalapa, Cosaguilapa, Lechonal }	450	.....	.....	.....
Hacienda del Pedregal	20	100	.....	.....
Idem del Calabozo	63	.....	.....	.....
Id. de Santa Catalina	210	1,000	10	2
Id. San Juan Bs. Nopalapam	435	30,000	4,000	180
Id. de Cuatotolapam	716	19,000	4,000	285
Ranchería de la Malota	287	.....	.....	.....
Id. de Corral Viejo	81	.....	.....	.....
Id. del Paso de San Juan	264	.....	.....	.....
Hacienda de Solcuautla	123	5,000	.....	.....
Id. de Santa Catalina de los Ortizes	133	1,300	360	18
Id. de San Felipe	254	.....	.....	.....
Ranchería de los Quemados	165	513	73	.....
Rancherías { Camahuacapa, Correa, Casas Viejas }	49	2,200	200	8
Hacienda de los Almagres	9	400	90	4
Idem de San Antonio	7	2,400	10	2
Id. de San José Teposapa	3,973	62,143	8,938	499

TABLE No. 5.

Summary of the statistical notices respecting the number of inhabitants and head of cattle in the isthmus of Tehuantepec.

Divisions.	Population.	Cattle.		
	Inhabitants.	Oxen.	Horses & mules.	Sheep.
Southern part of the isthmus.....	30,845	44,135	11,260	1,500
Northern part.....	21,011	67,143	25,000	230
Total.....	51,856	111,278	36,260	1,730

NOTE.—In all the proper names of places mentioned in the preceding report, whenever the letter *x* occurs it ought to be pronounced as the French *ch*, or the English *sh*, this sound having been expressed by an *x* in all the Mexican dictionaries from the period of the conquest.

Extract from Political Essay on the Kingdom of Spain. (Humboldt's,) vol. 1, chap. 2, b. 1.

The kingdom of New Spain, the most northern part of all Spanish America, extends from the 16th to the 38th degree of latitude. The length of this vast region, in the direction of south-southeast to north-northwest is nearly 270 myriametres, (or 610 common leagues;) its greatest breadth is under the parallel of the 30th degree. From the *Red river* of the province of *Texas* (Rio Colorado) to the isle of *Tiburon*, on the coast of the intendancy of *Sonora*, the breadth from east to west is 160 myriametres (or 364 leagues.)

The part of Mexico in which the two oceans, the Atlantic and the South sea, approach the nearest to one another, is, unfortunately, not that part which contains the two ports of Acapulco and Vera Cruz, and the capital of Mexico. There are, according to my astronomical observations, from *Acapulco* to *Mexico* an oblique distance of 2° 40′ 19″, (or 155,885 toises;*) from Mexico to Vera Cruz 2° 57′ 9″, (or 158,578 toises;†) and from the port of Acapulco to the port of Vera Cruz, in a direct line, 4° 10′ 7″. It is in these distances that the old maps are most faulty. From the observations published by M. de Cassini, in the account of the voyage of Chappe, the distance from Mexico to Vera Cruz appears 5° 10′ of longitude instead of 2° 57′, the real distance between these two great cities. In adopting for Vera Cruz the longitude given by Chappe, and for Acapulco that of the map of the depôt drawn up in 1784, the breadth of the Mexican isthmus betwixt the two ports would be 175 leagues, 75 leagues beyond the truth.

The isthmus of Tehuantepec, to the southeast of the port of *Vera Cruz*, is the point of New Spain in which the continent is the narrowest. From the Atlantic ocean to the South sea the distance is 45 leagues. The approximation of the sources of the rivers *Huasacualco* and *Chimalapa* seems to favor the project of a canal for interior navigation; a project with which the Count of Revillagigedo, one of the most zealous viceroys for the public good, has been for a long time occupied. When we come to speak of the intendancy of Oaxaca, we shall return to this object, so important to all civilized Europe. We must confine ourselves here to the *problem of the communication between the two seas*, in all the generality of which it is susceptible. We shall present in one view nine points, several of which are not sufficiently known in Europe, and all offer a greater or less probability either of canals or interior river communications. At a time when the new continent, profiting by the misfortunes and perpetual dissensions of Europe, advances rapidly towards civilization; and when the com-

*997,664 feet.
†1,014,680 feet.

merce of China and the northwest coast of America, becomes yearly of greater importance, the subject which we here summarily discuss is of the greatest interest for the balance of commerce, and the political preponderancy of nations.

These nine points, which at different times have fixed the attention of statesmen and merchants in the colonies, present very different advantages. We shall range them according to their geographical position, beginning with the most northern part of the new continent, and following the coast to the south of the island of *Chiloe*. It can only be after having examined *all* the projects hitherto formed for the communication of the two seas, that the government can decide which of them merits the preference. Before this examination, exact materials for which are not yet collected, it would be imprudent to cut canals in the isthmus of *Guasacualco* or *Panama*.

1. Under the 54° 37′ of north latitude in the parallel of *Queen Charlotte's island*, the source of the river of Peace, or *Ounigigah*, approached to within seven leagues of the sources of the *Tacoutche Tesse*, supposed the same with the river of *Columbia*. The first of these rivers discharges itself into the Northern ocean, after having mingled its waters with those of the *Slave lake* and the river Mackenzie. The second river Columbia, enters the Pacific ocean near cape *Disappointment*, to the south of Nootka sound, according to the celebrated voyager Vancouver, under the 46° 19′ of latitude. The Cordillera, or chain of the *stony mountains*, abounding in coal, was found by *M. Fiedler* to be elevated in some places 3,520 English feet,* or 550 toises above the neighboring plains. It separates the source of the rivers of *Peace* and Columbia. According to Mackenzie's account, who passed the Cordillera in the month of August, 1793, it is practicable enough for carriages, and the mountains appear of no very great elevation. To avoid the great winding of the Columbia, another communication still shorter might be opened from the sources of the *Tucouche Tesse* to the Salmon river, the mouth of which is to the east of the *Princess Royal islands*, in the 52° 26′ of latitude. Mackenzie rightly observes, that the government which should open this communication between the two oceans, by forming regular establishments in the interior of the country, and at the extremities of the rivers, would get possession of the whole fur trade of North America, from the 48° of latitude to the pole, excepting a part of the coast which has been long included in Russian America. *Canada*, from the multitude and course of its rivers, present facilities for internal commerce similar to those of *Oriental Siberia*. The mouth of the river Columbia seems to invite Europeans to found a fine colony there; for its banks afford fertile land in abundance, covered with superb timber.

*If it be true that this chain of mountains enters the region of perpetual snow, (Mackenzie v. iii., p. 331,) their *absolute height* should be at least from 1,000 to 1,100 toises, (from 6,400 to 7,040 English feet;) from whence it would follow, either that the neighboring plains, on which M. Fiedler was stationed to establish his measurements, are elevated from 450 to 550 toises above the level of the sea, or that the summits, of which this traveller indicates the height, are not the most elevated of the chain crossed by Mackenzie.

It must be allowed, however, that notwithstanding the examination by Mr. Broughton, we still know but a very small part of Columbia, which, like the *Severn* and the Thames, appears of a disproportionate contraction as it leaves the coast. Every geographer, who carefully compares Mackenzie's maps with Vancouver's, will be astonished at the *Columbia* in descending from these *Stony mountains*, which we cannot help considering as a prolongation of the *Andes* of Mexico, should traverse the chain of mountains which approach the shore of the great ocean, whose principal summits are *Mount St. Helen* and *Mount Rainier*. But *M. Malte-Brun* has started important doubts concerning the identity of the *Tacoutche Tesse* and the *Rio Columbia*. He even presumes that the former discharges itself into the Gulf of California; a bold supposition, which would give to the *Tacoutche Tesse* a course of an enormous length. It must be allowed that all that part of the west of North America is still but very imperfectly known.

In the 50° of latitude, the *Nelson* river, the *Saskashawan*, and the *Missouri*, which may be regarded as one of the principal branches of the *Mississippi*, furnish equal facilities of communication with the Pacific ocean. All these rivers take their rise at the foot of the *Stony mountains*. But we have not yet sufficient acquaintance with the nature of the ground through which the communication is proposed to be established, to pronounce upon the utility of these projects. The journey of Captain Lewis, at the expense of the Anglo-American government, on the Mississippi and Missouri, may throw considerable light on this interesting problem.

2. Under the 40° of latitude, the sources of the *Rio del Norte*, or *Rio Bravo*, a considerable river which flows into the Gulf of Mexico, are only separated from the sources of the *Rio Colorado* by a mountainous tract of from twelve to thirteen leagues of breadth. This tract is the continuation of the *Cordillera* of the *Cranes*, which stretches towards the *Sierra Verde* and the lake *Timpanogos*, celebrated in the Mexican history. The *Rio S. Rafael* and the *Rio S. Xavier*, are the principal sources of the river *Zaguananas*, which, with the *Rio de Neibajoa*, forms the *Rio Colorado*. The latter has its *embouchure* in the Gulf of California. These regions, abounding in rock salt, were examined, in 1777, by two travellers, full of zeal and intrepidity, monks of the order of St. Francis, Father *Escalante* and Father *Antonio Velez*. But however interesting the *Rio Zaguananas* and the *Rio del Norte* may one day become for the internal commerce of this northern part of New Spain, and however easy the carriage may be across the mountains, no communication will ever result from it comparable to that opened directly from sea to sea.

3. The *isthmus of Tehuantepec* comprises, under the 16° of latitude, the sources of the *Rio Huasacualco*, which is discharged into the Gulf of Mexico, and the sources of the *Rio de Chimalapa*. The waters of this last river mix with those of the Pacific ocean near the *Barra de S. Francisco*. I consider here the *Rio del Passo* as the principal source of the river *Huasacualco*, although

the latter only takes its name at the *Passo de la Fabrica*, after one of its arms, which comes from the mountains *de los Mexes*, unites with the *Rio del Passo*. We shall examine afterwards the possibility of cutting a canal, of from six to seven leagues, in the forests of *Tarifa*. We shall merely observe here that since, in 1798, a road has been opened, which leads by land from the port of *Tehuantepec* to the *Embarcadero de la Cruz*, (a road completed in 1800,) the *Rio Huasacualco* forms, in reality, a commercial communication between the two oceans. During the course of the war with the English, the indigo of *Guatemala*, the most precious of all known indigoes, came by the way of this isthmus to the port of *Vera Cruz*, and from thence to Europe.

4. The great lake of *Nicaragua* communicates not only with the lake of *Leon*, but also on the east, by the river *San Juan*, with the sea of the *Antilles*. The communication with the Pacific ocean would be effected in cutting a canal across the isthmus which separates the lake from the gulf of *Papagayo*. On this strait isthmus are to be found the volcanic and isolated summits of *Bombacho*, (at 11° 7′ of latitude,) of Grenada, and of the Papagayo, (at 10° 50′ of latitude.) The old maps point out a communication by water as existing across the isthmus from the lake to the great ocean. Other maps, somewhat newer, represent a river under the name of *Rio Partido*, which gives one of its branches to the Pacific ocean, and the other to the lake of Nicaragua; but this divided stream does not appear on the last maps published by the Spaniards and English.

There are in the archives of Madrid several French and English memoirs, on the possibility of the junction of the lake of Nicaragua with the Pacific ocean. The commerce carried on by the English on the coast of *Mosquitos* has greatly contributed to give celebrity to this project of communication between the two seas. In none of the memoirs which have come to my knowledge is the principal point, the height of the ground in the isthmus, sufficiently cleared up.

From the kingdom of *New Grenada* to the environs of the capital of Mexico, there is not a single mountain, a single level, a single city, of which we know the elevation above the level of the sea. Does there exist an *uninterrupted* chain of mountains in the provinces of *Veragua* and *Nicaragua*? Has this cordillera, which is supposed to unite the Andes of Peru to the mountains of Mexico, its *central chain* to the west or the east of the lake of *Nicaragua*? Would not the isthmus of *Papagayo* rather present a hilly tract than a continued corderilla? These are problems whose solution is equally interesting to the statesman and the geographical naturalist!

There is no spot on the globe so full of volcanoes as this part of America, from the 11° or 13° of latitude; but do not these conical summits form groups which, separately from one another, rise from the plain itself? We ought not to be astonished that we are ignorant of these very important facts; we shall soon see that even the height of the mountains which traverse the isthmus of Panama is

not yet known. Perhaps the communication of the lake of Nicaragua with the Pacific ocean could be carried on by the lake of *Leon*, by means of the river Tosta, which, on the road from *Leon* to Realexo, descends from the volcano of *Felica*. In fact, the ground appears there very little elevated. The account of the voyage of *Dampier* leads us even to suppose that there exists no *chain of mountains* between the lake of Nicaragua and the South sea. "The coast of Nocoya," says this great navigator, "is low, and covered at full tide. To arrive from *Realexo* to Leon, we must go twenty miles across a country, flat and covered with mangle trees." The city of Leon itself is situated in a savanna. There is a small river which, passing near Realexo, might facilitate the communication between the latter port and that of Leon. From the west bank of the lake of Nicaragua there are only four marine leagues to the bottom of the Gulf of *Papagayo*, and seven to that of Nicoya, which navigators call *la Caldera*. Dampier says expressly that the ground between *la Caldera* and the lake is a little hilly, but for the greatest part level and like a savanna.

The coast of *Nicaragua* is almost inaccessible in the months of August, September, and October, on account of the terrible storms and rains; in January and February, on account of the furious northeast and east-northest winds, called Papagayos. This circumstance is exceedingly inconvenient for navigation. The port of *Tehuantepec*, on the isthmus of *Guasacualco*, is not more favored by nature; it gives its name to the hurricanes which blow from the northwest, and which frighten vessels from landing at the small ports of *Sabinas* and *Ventosa*.

5. The *isthmus* of *Panama* was crossed for the first time by *Vasco Nunez de Balboa* in 1513. Since this memorable epocha in the history of geographical discoveries, the project of a canal has occupied every mind; and yet, at this day, after the lapse of 300 years, there neither exists a survey of the ground, nor an exact determination of the positions of *Panama* and *Porto Bello*. The longitude of the first of these two ports has been found with relation to Carthagena; the longitude of the second has been fixed from Guayaquil. The operations of *Fidalgo* and *Malaspina* are undoubtedly deserving of very great confidence; but errors are insensibly multipled, when, by chronometrical operations from the isle of *Trinidad Porto Bello*, and from *Lima* to *Panama*, one position becomes dependent on another. It would be important to carry the time directly from *Panama* to *Porto Bello*, and thus to connect the operations in the South sea with those which the Spanish government has carried on in the Atlantic ocean. Perhaps MM. *Fidalgo*, *Fiscar*, and *Noguera* may one day advance with their instruments to the southern coast of the isthmus, while MM. *Colmenares*, *Irasvirivill*, and *Quartara* shall carry their operations* to the northern coast.

*These officers of the Spanish marine were charged with surveying the northern and western coast of South America. The expedition of Fidalgo was destined for the coast sit-

To form an idea of the uncertainty which still prevails as to the form and breadth of the isthmus, (for example towards *Nata*,) we have only to compare the maps of Lopez with those of Arrowsmith, and with the more recent ones of the *Deposito Hydrografico* of Madrid. The river *Chagres*, which flows into the sea of the Antilles to the west of *Porto Bello*, presents, notwithstanding its sinuosities and its rapids, great facility for commerce; its breadth is 120 toises at its mouth, and 20 toises near *Cruces*, where it begins to be navigable. It requires four or five days, at present, to ascend the *Rio Chagres*, from its mouth to *Cruces*. If the waters are very high, the current must be struggled with for ten or twelve days. From *Cruces* to Panama, merchandises are transported on the backs of mules, for a space of five small leagues. The barometrical height related in the travels of Ulloa leads me to suppose that there exists in the Rio Chagres, from the sea of the Antilles to the *Embarcadero*, or *Venta de Cruces*, a difference of level of from 35 to 40 toises. This must appear a very small difference to those who have ascended the *Rio Chagres*; they forgot that the force of the current depends as much on a great accumulation of water near the sources, as on the general descent of the river; that is to say, of the descent of the *Rio Chagres* above *Cruces*. On comparing the barometrical survey of Ulloa with that made by myself in the river of *Magdelen*, we perceive that the elevation of *Cruces* above the ocean, far from being small, is, on the contrary, very considerable. The fall of the *Rio de la Madelena*, from Honda to the dike of *Mahates*, near *Barrancas*, is nearly 170 toises; and this distance, nevertheless, is not, as we might suppose, four times, but eight times greater than that of Cruces at the fort of *Chagres*.

The engineers, in proposing to the court of Madrid that the river *Chagres* should serve for establishing a communication between the two oceans, have projected a canal from *Venta de Cruces* to *Panama*. This canal would have to pass through a hilly tract, of the height of which we are completely ignorant. We only know that, from *Cruces*, the ascent is at first rapid; and that there is then a descent for several hours towards the South sea. It is very astonishing that, in crossing the isthmus, neither *La Condamine*, nor *Don George Juan* and *Ulloa*, had the cariosity to observe their barometer, for the sake of informing us what is the height of the most elevated point on the route, of the castle of *Chagres*, at *Panama*. These illustrious *savans* sojourned three months in that interesting region for the commercial world; but their stay has added little to the old observations which we owe to *Dampier* and to *Wafer*. However, it appears, beyond a doubt, that we find the principal *Cordillera*, or rather a range of hills, that may be regarded as a prolongation of the *Andes* of *New Grenada* towards the South sea, between *Crutes* and *Panama*. It is from

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nated between the isle of *Trinidad* and *Porto Bello;* the expedition of *Colmenares* for the coast of *Chili;* and the expedition of *Moraleda* and *Quartara* for the part between *Guayaquil* and *Realejo*.

thence that the two oceans are said to be discernible at the same time, which would only require an absolute height of 290 metres.* However, *Lionel Wafer* complains that he could not enjoy this interesting spectacle. He assures us, moreover, that the hills which form the central chain; are separated from one another by valleys which allow *free course* for passage of the rivers. If this last assertion be well founded, we might believe in the possibility of a canal from *Cruces* to *Panama*, of which the navigation would only be interrupted by a very few locks.

There are other points, where, according to memoirs drawn up in 1528, the isthmus has been proposed to be cut: for example, in joining the sources of the rivers called *Caimito* and *Rio Grande*, with the *Rio Trinidad*. The eastern part of the isthmus is the narrowest, but the ground appears to be also most elevated there. This is at least what has been remarked in the frightful road travelled by the courier from Porto Bello to Panama, a two days' journey, which goes by the village of *Pequeni*, and is full of the greatest difficulties.

In every age and clime, of two neighboring seas, the one has been considered as more elevated than the other. Traces of this vulgar opinion are to be found among the ancients. *Strabo* relates that, in his time, the Gulf of Corinth, near *Lechacum*, was believed to be above the sea of *Cenchreae*. He is of the opinion that it would be very dangerous to cut the isthmus of the Peloponnesus in the place where the Corinthians, by means of particular machines, had established a *portage*. In America, the South sea is generally supposed to be higher, at the isthmus of Panama, than the Atlantic ocean. After a struggle of several days against the current of the Rio Chagres, we naturally believe the ascent to be greater than the descent from the hills, near *Cruces*, to *Panama*. Nothing, in fact, can be more treacherous than the estimates which we are apt to form of the difference of level on a long and easy descent. I could hardly believe my own eyes at Peru, when I found, by means of a barometrical measurement, that the city of *Lima* was 91 toises† higher than the port of Callao. An earthquake must cover entirely the rock of the isle of *San Lorenzo* with water before the ocean can reach the capital of Peru. The idea of a difference of level between the Atlantic and South sea, has been combatted by *Don George Juan*, who found the height of the column of mercury the same at the mouth of the *Chagres* and at *Panama*.

The imperfection of the meteorological instruments then in use, and the want of every sort of thermometrical correction of the calculation of heights, might also give rise to doubts. These doubts have acquired additional force since the French engineers, in the expedition to Egypt, found the *Red Sea* six toises‡ higher than the *Mediterranean*. Till a geometrical survey be executed in

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*947 English feet.
†582 feet.
‡38 feet.

the isthmus itself, we can only have recourse to barometrical measurements. Those made by me at the mouth of the *Rio Sinu* in the Atlantic sea, and on the coast of the South sea in Peru, prove, with every allowance for temperature, that if there is a difference of level between the two seas, it cannot exceed six or seven metres.*

When we consider the effect of the *current* of *rotation*, which carries the waters from east to west, and accumulates them towards the coast of *Costa Ricca* and *Veragua*, we are tempted to admit, contrary to the received opinion, that the Atlantic is a little higher than the South sea. Trivial causes of a local nature, such as the configuration of the coast, currents, and winds (as in the straits of *Babelmandel*,) may trouble the equilibrium which ought necessarily to exist between all the parts of the ocean. As the tides rise at Porto Bello to a third part of a metre,† and at Panama to four or five metres,‡ the levels of the two neighboring seas ought to *vary* with the different *establishments of the ports*. But these trivial inequalities, far from obstructing hydraulic operations, would even be favorable for sluices.

We cannot doubt that if the isthmus of *Panama* were once burst by some similar catastrophe to that which opened the columns of Hercules, the current of rotation, in place of ascending towards the Gulf of Mexico, and issuing through the canal of Bahama, would follow the same parallel from the coast of Paria to the Philippine islands. The effect of this opening, or new strait, would extend much beyond the banks of *Newfoundland*, and would either occasion the disappearance or diminish the celerity of the Hotwater river, known by the name of *gulf stream*, which, leaving Florida on the northeast, flows in the 40° of latitude to the east and especially to the southeast towards the coast of Africa. Such would be the effects of an inundation analogous to that of which the memory has been preserved in the traditions of the Samothracians. But shall we dare to compare the pitiful works of man with canals cut by nature herself—with straits like the Hellespont and Dardanelles!

Strabo appears inclined to believe that the sea will one day open the isthmus of Suez. No such catastrophe can be expected in the isthmus of Panama, unless enormous volcanic convulsions, very improbable in the actual state of repose of our planet, should occasion extraordinary revolutions. A tongue of land lengthened out from east to west, in a direction almost parallel to that of the current of rotation, escapes, as it were, the shock of the waves. The isthmus of Panama would be seriously threatened, if it extended from south to north, and was situated between the port of *Carthago* and the mouth of the *Rio San Juan*, if the narrowest part of the new continent lay between the 10° and the 11° of latitude.

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*19 or 22 feet.
†13 inches.
‡13 or 16 feet.

The navigation of the river *Chagres* is difficult on account of its sinuosities and the celerity of the current, frequently from one to two metres per second.* These sinuosities, however, afford a *counter current*, by means of which the small vessels, called *bongos* and *chatas*, ascend the river, either with oars, poles, or towing. Were these sinuosities to be cut, and the old bed of the river to be dried up, this advantage would cease, and it would be infinitely difficult to arrive from the North sea to Cruces.

From all the information which I could procure relating to this isthmus, while I remained at *Carthagena* and *Guayaquil*, it appears to me that the expectation of a canal of seven metres† in depth, and from twenty-two to twenty-eight metres‡ in breadth, which, like a pass or a strait, should go from sea to sea, and admit the vessels which sail from Europe to the East Indies, ought to be completely abandoned. The elevation of the ground would force the engineer to have recourse either to subterraneous galleries, or to the system of sluices; and the merchandises destined to pass the isthmus of Panama could only, therefore, be transported in flat bottomed boats unable to keep the sea. Entrepots at Panama and Porto Bello would be requisite. Every nation which wished to trade in this way would be dependent on the masters of the isthmus and canal; and this would be a very great inconvenience for the vessels despatched from Europe. Supposing, then, that this canal were cut, the greatest number of these vessels would probably continue their voyage round *Cape Horn*. We see that the passage of the sound is still frequented, notwithstanding the existence of the *Eyder* canal, which connects the ocean with the Baltic sea.

It would be otherwise with the productions of western America, or the goods sent from Europe to the coast of the Pacific ocean. These goods would cross the isthmus at less expense, and with less danger, particularly in time of war, than in doubling the southern extremity of the new continent. In the present state of things, the carriage of three quintals on mule back from *Panama* to *Porto Bello* costs from three to four piastres, (from 12*s*. 6*d*. to 16*s*. 8*d*.) But the uncultivated state in which the government allows the isthmus to remain, is such that the carriage of the copper of Chili, the quinquina of Peru, and the 60 or 70,000 vanegas of cacao§ annually exported by Guayaquil across this neck of land, requires many more beasts of burden than can be procured; so that the slow and expensive navigation round Cape Horn is preferred.

In 1802 and 1803, when the Spanish commerce was everywhere harassed by the English cruisers, a great part of the cacao was carried across the kingdom of New Spain, and embarked at *Vera Cruz* for Cadiz. They preferred the passage from *Guayaquil* to *Acapulco*, and a land journey of a hundred leagues from *Acapulco*

* From 3.28 to 6.56 feet.
† 22 feet 11 inches.
‡ From 72 feet 2 inches to 91 feet 10 inches.
§ A vanega weighs 110 Castilian pounds.

to *Vera Cruz*, to the danger of a long navigation by Cape Horn, and the difficulty of struggling with the current along the coast of Peru and Chili. This example proves that, if the construction of a canal across the isthmus of Panama, or that of Huasacualco, abounds with too many difficulties from the multiplicity of sluices, the commerce of America would gain the most important advantages from good causeways, carried from *Tehuantepec* to the *embarcadero de la Cruz*, and from Panama to *Porto Bello*. It is true that, in the isthmus, the pasturage to this day is very unfavorable to the nourishment and multiplication of cattle; but it would be easy in so fertile a soil to form savannas, by cutting down forests; or to cultivate the *paspalum purpureum*, the *milium nigricans*, and particularly the *medicago sativa*, which grows abundantly in Peru in the warmest districts.

The introduction of camels would be still a surer means of diminishing the expense of carriage. These *land ships*, as they are called by the Orientals, hitherto exist only in the province of *Caraccas*, and were brought there from the *Canary* islands by the Marquis de Toro.

Moreover, no political consideration should oppose the progress of population, agriculture, commerce and civilization in the isthmus of Panama. The more this neck of land shall be cultivated, the more resistance will it oppose to the enemies of the Spanish government. The events which took place at *Buenos Ayres* prove the advantages of a concentrated population in the case of an invasion. If any enterprising nation wished to become possessed of the isthmus, it could do so with the greatest ease at present, when good and numerous fortifications are destitute of arms to defend them. The unhealthiness of the climate, though now much diminished at Porto Bello, would alone oppose great obstacles to any military undertaking in the isthmus. It is from *St. Charles de Chiloe*, and not from Panama, that Peru can be attacked. It requires from three to five months to ascend from Panama to Lima. But the whale and cachalot fishery, which in 1803 drew sixty English vessels to the South sea, and the facilities for the Chinese commerce and the furs of the Nootka sound, are baits of a very seductive nature. They will draw, sooner or later, the masters of the ocean to a point of the globe destined by nature to change the face of the commercial system of nations.

6. To the southeast of *Panama*, following the coast of the Pacific ocean, from Cape *St. Miguel* to Cape *Corientes*, we find the small port and bay of Cupica. The name of this bay has acquired celebrity in the kingdom of New Grenada, on account of a new plan of communication between the two seas. From Cupica, we cross for five or six marine leagues a soil quite level and proper for a canal, which would terminate at the embarcadero of the Rio Naipi. This last river is navigable, and flows below the village of Zitara into the great Rio Atrato, which itself enters the Atlantic sea. A very intelligent Bicayan, M. Gogueneche, was the first who had the merit of turning the attention of government to the bay of Cupica, which ought to be for the new continent what Suez

was formerly for Asia. M. Gogueneche proposed to transport the cacao of Guayaquil by the Rio Naipi to Carthagena. The same way offers the advantage of a very quick communication between *Cadiz* and *Lima;* instead of despatching couriers by *Carthagena*, *Santa Fe* and *Quito*, or by *Buenos Ayres* and *Mendoza*, good quick sailing packet boats should be sent from *Cupica* to *Peru*. If this plan were carried into execution, the viceroy of Lima would have no longer to wait five or six months for the orders of his court; besides, the environs of the *bay* of *Cupica* abound with excellent timber, fit to be carried to Lima. We might almost say that the ground between *Cupica* and the mouth of the *Atrato* is the only part of all America in which the *chain of the Andes* is entirely broken.

7. In the interior of the province of *Choco*, the small ravine (quebrada) *de la Raspadura* unites the neighboring sources of the *Rio de Noamama*, called also *Rio San Juan*, and the small river Quito. The latter, the *Rio Andageda* and the *Rio Zitara*, form the *Rio d'Atrato*, which discharges itself into the Atlantic ocean, while the *Rio San Juan* flows into the South sea. A monk of great activity, *curé* of the village of *Novita*, employed his parishioners to dig a small canal in the ravine *de la Raspadura*, by means of which, when the rains are abundant, canoes loaded with cacao *pass from sea to sea*. This interior communication has existed since 1788, unknown in Europe. The small canal of Raspadura unites on the coast of the two oceans, two points seventy-five leagues distant from one another.

8. In the 10° of south latitude, two or three days' journey from Lima, we reach the banks of the *Rio Guallaga*, (or Huallaga,) by which we may, without doubling Cape Horn, arrive at the banks of the *Grand Para* in Brazil. The sources even of the *Rio Huanuco*, which runs into the *Guallaga*, are only four or five leagues distant from the source of the *Rio Huaura*, which flows into the Pacific ocean. The *Rio Xauxo*, also, which contributes to form the *Apurémac* and the *Ucayale*, has its rise near the source of the *Rio Rimac*. The height of the Cordillera, and the nature of the ground, render the execution of a canal impossible; but the construction of a commodious road from the capital of Peru to the *Rio de Huanuco*, would facilitate the transport of goods to Europe. The great rivers Ucayale and Guallaga would carry, in five or six weeks, the productions of Peru to the mouth of the *Amazons*, and to the neighboring coasts of Europe, while a passage of four months is requisite to convey the same goods to the same point in doubling Cape Horn. The cultivation of the fine regions situated on the *eastern declivity* of the Andes, and the prosperity and wealth of their inhabitants, depend on *a free* navigation of the river of the Amazons. This liberty, denied by the court of Portugal to the Spaniards, might have been acquired in the sequel to the events which preceded the peace of 1801.

9. Before the *coast of the Patagonians* was sufficiently known, the *Gulf of St. George*, situated between the 45° and the 47° of south latitude, was supposed to enter so far into the interior of the

country as to communicate with the arms of the sea which interrupt the continuity of the western coast; that is to say, with the coast opposite to the archipelago of *Chayamapu*. Were this supposition founded on solid bases, the vessels destined from the South sea might cross South America 7° to the north of the straits of *Magellan*, and shorten their route more than 700 leagues. In this way, navigators might avoid the dangers which, notwithstanding the perfection of nautical science, still accompany the voyage round Cape Horn, and along the Patagonian coast, from Cape *Pilares* to the parallel of the *Chonos* islands. These ideas, in 1790, occupied the attention of the court of Madrid. M. *Gil Lemos*, viceroy of Peru, an upright and zealous administrator, equipped a small expedition, under the orders of *M. Moraleda*, to examine the southern coast of Chili. I saw the instructions that he received at Lima, which recommended to him the greatest secresy, in case he should be happy enough to discover a *communication between the two seas*. But M. Moraleda discovered, in 1793, that the *Estero de Aysen*, visited before him in 1763 by the Jesuits, fathers *Jose Garcia* and *Juan Vicuña*, was, of all the arms of the sea, that in which the waters of the ocean advance the farthest towards the east. Yet it is but eight leagues in length, and terminates at the isle *de la Cruz*, where it receives a small river, near a hot spring. Hence, the canal of Aysen, situated in the 45° 28′ of latitude, is still 88 leagues distant from the Gulf of St. George. This gulf was exactly surveyed by the expedition of Malaspina. In the year 1746, a communication was, in the same manner, suspected in Europe between the bay of St. Julien (latitude 50° 53′) and the great ocean.

I have sketched in one plate the nine points which appear to afford means of communication between the two oceans, by the junction of neighboring rivers, either by canal or carriage roads between the places where the rivers become navigable. These sketches are not of equal accuracy, astronomically considered; but I wished to save the reader the labor of seeking in several maps what may be contained in one; and it is the duty of the government, which possesses the finest and most fertile part of the globe, to perfect what I have merely hinted at in this discussion. Two Spanish engineers, MM. *Le Maur*, drew up superb plans of the canal *de los Guines*, projected for traversing the whole island of *Cuba*, from *Batabono* to the *Havannah*. A similar survey of the isthmus of *Huasacualco*, the Lake Nicaragua, of the country between *Cruces* and *Panama*, and between *Cupica* and the *Rio Naipi*, would direct the statesman in his choice, and enable him to decide, if it is at Mexico or Darien that this undertaking should be executed; an undertaking calculated to immortalize a government occupied with the true interests of humanity.

The long circumnavigation of South America would then be less frequent, and a communication would be opened for the goods which pass from the Atlantic ocean to the South sea. The time is past when Spain, through a jealous policy, refused to other nations a thoroughfare through the possession of which she so long kept the world in ignorance. Those who are at present at the head of

the government are enlightened enough to give a favorable reception to the liberal ideas proposed to them; and the presence of a stranger is no longer regarded as a danger for the country.

Should a canal of communication be opened between the two oceans, the productions of *Nootka sound* and of *China* will be brought more than 2,000 leagues nearer to Europe and the United States. Then only can any great changes be effected in the political state of *eastern Asia;* for this neck of land, the barrier against the waves of the Atlantic ocean, has been for many ages the bulwark of the independence of *China* and Japan.

Extract from Political Essay on the Kingdom of New Spain.
(Humboldt's New Spain, vol. 4, book 5, chap. xii.)

After the taking of Mexico, Gonzalo de Sandoval conquered the province of Tehuantepec in 1521, and through Andre Niño, the pilot, affirmed that there was no strait from the coast of Nicaragua to the isthmus of Tehuantepec; this isthmus was, nevertheless, looked upon as of very great importance, because the proximity of the two seas and the river Huasacualco afforded the first Spanish conquerers a facility in transporting from Vera Cruz to the coast of the Pacific ocean the necessary materials for the construction of vessels. The expedition of Hernando de Grixalva, who set sail for California in 1534, went from Tehuantepec; and in the same manner the vessels in which Cortez embarked at Chametla, were constructed at the mouth of the Rio Chimalapa, of the materials brought by the Rio Huasacualco. One of these vessels was lost in crossing the bar of St. Francis, on leaving the *Laguna de Santa Teresa.*

Since the end of the 16th century the port of Tehuantepec, which hardly deserves the name of road, has been very little frequented; the South-sea commerce has been concentrated at Acapulco, and the embarcations necessary for communication with the Philippine islands have all taken place at Manilla or the port of San Blas. Besides, the sea is daily withdrawing from the coast of Tehuantepec, the anchorage is yearly becoming worse, and the sand brought down by the river Chimalapa augments both the height and extent of the bar. At present, the distance from the Villa de Tehuantepec to the sea is four leagues by the way of the Hacienda de la Zoleta; and the best anchorage is at the Morro del Carbon, at the salt pits, and in the Laguna de Santa Teresa.

A fortunate accident, towards the end of the last century, was the means of occasioning the two viceroys, Buccareli and Revillagigedo, again to turn the attention of government to the Isthmus of Tehuantepec and the Rio de Huasacualco. There was discovered in 1771, at Vera Cruz, amongst the artillery of the castle of St. Juan de Ulua, several pieces of cannon cast at Manilla. As it was known that, before the year 1767, the Spaniards neither doubled the Cape of Good Hope nor Cape Horn in their voyage to the Philippine islands, and that since the first expeditions of Magellan and Loysa, who set out from Spain, all the commerce of Asia was carried on in the Galleon of Acapulco, they could not conceive how these guns had crossed the continent of Mexico on their way from Manilla to the Castle of Ulua. The extreme difficulty of the road from Acapulco to Mexico, and from thence to Xalapa and Vera Cruz, rendered it very improbable that they should come by that way. In the course of their investigations they learned, both from the chronicle of Tehuantepec, written by Father Burgoa, and from the traditions preserved among the inhabitants of the Isthmus of Huasacualco, that these guns were cast at the Island

of Luzon, and landed at the bar of San Francisco; that they had ascended the bay of Santa Teresa and the Rio Chimalapa; that they had been carried by the farm of Chivela and the forest of Tarifa to the Rio del Malpasso; and that, after having been again embarked, they descended the Rio Huasacualco to its mouth in the Gulf of Mexico.

It was then very reasonably observed that this road, which had been frequented in the beginning of the conquest, might still become very useful for the opening a direct communication between the two seas. The viceroy, Don Antonio Bucareli, gave orders to two able engineers, Don Augustin Cramer and Don Miguel del Corral, to examine with the greatest minuteness the country between the bar of Huasacualco and the road of Tehuantepec; and he instructed them at the same time to verify whether, as was vaguely supposed, among the small rivers of Ostuta, Chicapa, or Chimalapa, there was none which in any of its branches communicated with the two seas. From the itinerary journals of these two engineers, of whom the former was lieutenant of the castle of Ulua, I drew up my map of the isthmus of Tehuantepec. They found that no river discharged at the same time its waters into the south sea and Atlantic ocean; that the Rio Huasacualco did not take its rise, as the viceroy had been informed, near the town of Tehuantepec; and that on ascending it beyond the catarace, even as far as the old *desembarcadero* de Malpasso, they were still more than 26 leagues distant from the shores of the South sea. They observed that a chain of mountains, of very inconsiderable height, divides the waters between the Gulf of Mexico and the Gulf of Tehuantepec. This small cordillera stretches from east to west, from the Cerros de los Mixes, formerly inhabited by a wild and warlike tribe, towards the elevated table land of Portillo de Petapa. The engineer, Cramer, affirms, however, that to the south of the village of Santa Maria de Chimalapa, the mountains form rather a group than an uninterrupted chain, and "that there exists a transversal valley, in which a canal of communication might be cut between the two seas." This canal, which would unite the Rio de Chimalapa with the Rio del Passo, (or Malpasso,) would only be six leagues in length; the boats would ascend the Rio Chimalapa, which affords a very easy navigation from Tehuantepec to the village of San Miguel; and from thence they would pass, by the canal projected in the time of Count Revillagigedo, to the Rio del Passo. This river discharges itself into the Rio de Huasacualco, near the *Bodegas de la Fabrica;* but its navigation is extremely difficult on account of the seven pyramids (*raudales*) which are counted between its source and the mouth of the Rio de Saravia.

It would be of infinite importance again to order this ground to be examined by intelligent engineers, to determine whether, as was believed by M. Cramer, the *canal between the two seas* can be executed without locks or without *inclined planes*, and whether by blowing up the rocks with powder, the beds of the rivers Passo and Chimalapa can be deepened. The isthmus is rich in cattle, and would, from its great fertility, supply valuable productions for the

commerce of Vera Cruz. The fine plains of Tehuantepec would be susceptible of irrigation from the Rio de Chimalapa; in their present state they produce a little indigo and cochineal of a superior quality.

Before setting on foot in the islands of Cuba and Pinos the felling of cedar and acajou wood, (cedrela odorata and swietenia mahogany,) the dock yards of the Havannah drew their wood for ship building from the thick forest which covers the northern slope of the Cerros de Petapa and Tarifa. The isthmus of Tehuantepec was at that time very much frequented, and the ruins of several houses, which are still to be seen on the two banks of the river Huasacualco, are to be dated back to that period. The cedar and acajou wood was embarked at the Bodegas de Malpasso.

To avoid the seven *rapids* of the Rio del Passo, a new port (desembarcadero) was established in 1798 at the mouth of the Rio Saravia; the salt provisions (tasajo) of Tehuantepec, the indigo of Guatemala, and the cochineal of Oaxaca, were conveyed by this way to Vera Cruz and the Havannah. A road has been opened from Tehuantepec, by Chihuitan, Llano Grande, Santa Maria Petapa, and Guchicovi, to the new port of la Cruz. They reckon this road 34 leagues. The productions destined for the Havannah do not descend to the mouth of the Rio Huasacualco, or to the small fort of that name, because they are afraid of exposing their canoes to the north winds during the long passage from the bar of Huasacualco to the port of Vera Cruz. They disembark the goods at the Passo de la Fabrica; and from thence they are conveyed on the backs of mules, by the village of Acayucan to the banks of the river San Juan, where they are again embarked in large canoes, and transported by the bar of Tlacatalpan to the port of Vera Cruz.

For some years the roads from Tarifa and Petapan have been encumbered by trunks of cedar trees, needlessly cut down by order of some commissaries of the royal marine. These trunks, the finest in the forest, are rotting, and no person thinks of transporting them to the Havannah. The inhabitants of the Spanish colonies are accustomed to measures like these without any result; and they attribute them to the facility with which all projects are undertaken and abandoned by the ministry. A short time before my residence on the banks of the Orinoco, *commissados del rey* ascended the river to the mouth of the Rio Carony, for the purpose of cutting down all the trees which might be useful in ship building. They measured their diameter and height, and marked so great a number of trunks of cedrela laurus, and caesalpinia, that all the dock yards of Europe could not have made use of them in ten years; but no tree was ever cut down; and this long and laborious labor produced no other effect than an increase of expense to government.

Extract from Humboldt's Personal Narrative of Travels, v. 6, parts 1 and 2, page 239 to 300.

United with the local interest of the internal navigation of Venezuela, is another intimately connected with the prosperity of the commercial nations of both hemispheres.

Among the five points that appear to present the practicability of opening a direct navigation between the Atlantic ocean and the South sea, three are found in the territory of Columbia. I will not here repeat what I have already observed on this important object, in the first volume of the Political Essay on New Spain, where I have shown that previously to undertaking any labors on either of those points they ought all to be examined. It is only by investigating an hydraulic problem in its greatest generality that it can be advantageously solved. Since I left the new continent no barometric measure or geodesic levelling has been executed to determine the lines of elevation which the projected canals ought to traverse. The different works that have appeared during the war of independence of the Spanish colonies, are confined to the same ideas which I published in 1800; it is only by the communications which I have since held with the inhabitants of regions the least visited that I have been able to obtain some new information. I shall here state the considerations that are most important for the political advantage and the trade of the nations.

The five points that present the practicability of a communication, from sea to sea, are situated between the 5th and 18th degrees of north latitude.

They all, consequently, belong to the States washed by the Atlantic, to the territory of the Mexican and Columbian confederations, or, to use the ancient geographical denominations, to the intendencies of Oaxaca, and Vera Cruz, and the provinces of Nicaragua, Panama, and Choco.

They are: the isthmus of Tehuantepec, (latitude 16°–18°,) between the sources of the Rio Chimalapa and the Rio del Passo, which empties itself into the Rio Huasacualco or Goazacoalcos.

The isthmus of Nicaragua, (latitude 10°–12°,) between the port of San Juan de Nicaragua, and the coast of the Gulf of Papagayo, near the volcanos of Granada and Bombacho.

The isthmus of Panama, (latitude 8° 15′–9° 36′.)

The isthmus of Darien, or Cupica, (latitude 6° 40′–7° 12′.)

The canal of Raspadura, between the Rio Atrato and the Rio San Juan of Choco, (latitude 4° 48′–5° 20′.)

Such is the happy position of these five points, of which the latter will probably be always confined to the system of small navigation, or inland communications, that they are placed at the centre of the new continent at an equal distance from Cape Horn and the northwest coast, celebrated for the fur trade.

Opposed to each (in the same parallel,) are the seas of China

and India, an important circumstance in latitudes where the trade-winds prevail; all are easily entered by vessels coming from Europe and the United States.

The most northern isthmus, that of Tehuantepec, which Hernan Cortez, in one of his letters to the emperor Charles V., (of the 30th October, 1520,) calls the secret of the strait, has so much the more, of late years, fixed the attention of navigators, that, during the political troubles of New Spain, the trade of Vera Cruz was divided between the small ports of Tampico, Tuxpan, and Huasacualco.

It has been calculated that the navigation from Philadelphia to Nootka, and the mouth of the Rio Columbia, which is nearly 5,000 marine leagues, taking the ordinary way round Cape Horn, would be shortened at least 3,000 leagues of the passage from Huasacualco to Tehuantepec could be effected by a canal.

Having had at my disposal, in the archives of the vice royalty of Mexico, the memoirs of two engineers, (Don Augustin Cramer and Don Miguel del Coral,) who were appointed to examine the isthmus, I have been able to form a precise idea of the local circumstances.

No doubt the ridge which forms the partition of the waters between the two seas, is interrupted by a transversal valley, in which a canal of derivation might be dug.

It has been recently asserted, that in the time of high floods this valley is filled with a sufficient quantity of water to admit of a natural passage for the boats of the Indians; but I found no indication of this interesting fact in the different official reports addressed to the viceroy, Don Antonio Bucareli.

Similar communications exist, at the period of great inundations, between the basins of the rivers St. Lawrence and Mississippi, that is, between the lake Erie and the Wabash, between the lake Michigan and the river of the Illinois.

The canal of Huasacualco, projected during the able administration of the Count de Revillagigedo, would join the Rio Chimalapa and the Rio del Passo, which is a tributary stream of the Huasacualco; it would be about 16,000 toises long, and from the description given of it by the engineer, Cramer, who enjoyed a high reputation, it appears that it would require neither sluices, subterranean galleries, nor the use of inclined planes. It must not, however, be forgotten that no barometric or geodesic levelling has been hitherto executed in the territory comprised between the ports of Tehuantepec and San Francisco de Chimalapa; between the sources of the Rio del Passo and Los Cerros de los Mixes. By glancing on the map I have sketched of those countries, we may conceive that the difficulty of this enterprise, which the government of Mexico is about to undertake, consists less in tracing the canal than in the labors necessary to render the Rio Chimalapa navigable for large vessels, as well as the seven rapids of the Rio del Passo, from the ancient *embarcadere*, on the north of the forests of Tarifa, to the mouth of the Rio Savaria, near the new embarcadére the breadth de la Cruz. It is to be feared that, on account

of the breadth of this isthmus (which is more than 38 leagues) the windings and the beds of the rivers will oppose obstacles to the project of opening a canal of sea navigation appropriated for vessels trading to China and the northwest coast of America; it would, therefore, be of the highest importance to establish a line of navigation for small craft, or to improve the road by land, passing by Chihuitan and Petapa.

This road was opened in 1798 and 1801, and the indigos of Guatemala, as well as cochineal and salt provisions, have long been conveyed by that route to Vera Cruz and the island of Cuba.

The isthmus of Nicaragua and that of Cupica have always appeared to me the most favorable for the formation of canals of large dimensions, similar to the Caledonian canal, which is 103 feet (French measure) broad at the water's edge, exclusive of the raised way which stops the falling in of the earth; 47 feet broad at the bottom, and 18½ deep. In considering a communication between two seas, capable of producing a reduction in the commercial world, we must not limit our attention to such means as only serve to establish a system of inland navigation by small locks, as in the canals of Lanquedoc, Briare, or in the Grand Junction, and the Forth and Clyde canals.

Some of those canals long appeared to be gigantic enterprises, and indeed they were so when compared with canals of smaller dimensions: but their *mean* depth not being more than from 6 to 7½ French feet, they cannot give a passage like the Caledonian canal, admit merchant vessels of heavy tonnage, and thirty-two gun frigates.

It is, however, the practicability of this passage which is discussed in the project of cutting an isthmus in America.

The pretended *junction of the two seas*, by the canal of Languedoc, has not spared the navigation a circuit of more than 600 leagues round the Spanish peninsula; and however admirable this hydraulic work may be which receives annually 1,900 flat-boats, carrying from 100 to 120 tons each, it can only be considered as a means of *inland carriage*, since it very little diminishes the number of vessels that pass through the straits of Gibraltar. It cannot be doubted, that if at any given point of equinoctial America, either in the isthmus of Cupica, or in those of Panama, Nicaragua, or even Huasacualco, two neighboring ports were joined by a *canal of small dimensions*, (of from four to seven feet deep,) it would produce great commercial activity. This canal would act like a railway, and small as it might be, would enliven and abridge the communications between the western coasts of America and those of the United States and of Europe. If even in time of war, the long and dangerous passage round Cape Horn has been generally preferred for the exportation of the copper of Chili, bark, the wool of the vigogne of Peru, and the cacao of Guayaquil, to the commercial *entrepôt* of Panama and Porto Bello, it is only on account of the want of the means of transport, and the extreme misery that prevails in those towns, which were so flourishing at the beginning of the conquest. The difficulties here men-

tioned increase in conveying merchandise from Carthagena or the West Indies to Quito and Lima; and when sent up in the direction from north to south, by the Rio Chagres, the force of its current must be overcome like that of the winds and currents of the Pacific oceans.

By rendering the Chagres navigable, employing long steamboats, establishing railways, introducing the camels of the Canaries, which at the time of my visit had begun to multiply in Venezuela, by digging small canals in the isthmus of Cupica, or on the neck of land that separates the lake of Nicaragua from the coast of the South sea, the prosperity of American industry might be increased, but very indirect influence would be exerted on the general interests of civilized nations.

The direction of the trade of Europe and the United States with the *fur coast*, (between the mouth of the Columbia and Cooke river,) with the Sandwich islands, rich in sandal wood, with India and China, would not be changed. Distant communications require ships of great tonnage, that admit of being heavily laden; natural or artificial passes of the mean depth of from 15 to 17 feet; and an uninterrupted navigation, requiring no unloading of the vessels.

These conditions are indispensable, and it would be changing the question to confound the canals which, by their dimensions, serve only to facilitate inland communications and a coasting trade, (like the canals of Languedoc and the Clyde, between the Mediterranean and the Atlan ocean, or between the Irish and North seas,) with basins and locks capable of receiving the ships employed in the trade of Canton.

In a matter that interests every nation which has made some progress in civilization, greater precision should be used than has hitherto been done respecting a problem, the successful application of which depends principally on the choice of the localities.

It would be imprudent, I here repeat, to begin at one point without having examined and levelled others; and it would be, above all, to be regretted, if the works were undertaken on too small a scale; for in works of this description, the expense does not augment in proportion to the section of the canals, or the breadth of the water channel.

The erroneous idea which geographers, or rather drawers of maps, have so long propagated, of the equal heights of the Cordilleras of America, their prolongation in the form of walls and continued ridges, and, finally, of the absence of any transversal valley crossing the pretended central chains, has caused it to be generally believed that the junction of the seas is an undertaking of greater difficulty than there has been hitherto reason to suppose.

It appears that there are no chains of mountains, not even a ridge of partition, or any sensible line of demarcation between the bay of Cupica, on the coast of the South sea, and the Rio Naipa, which empties itself into the Atrato, fifteen leagues above its mouth. A Biscayan pilot, M. Goguenèche, called the attention of government to this point, in the year 1799.

Persons worthy of credit, who had made the passage with him

from the Pacific sea to the embarcadere of Naipi, assured me that they saw no hill in that isthmus of alluvial earth which they were ten hours in crossing. A merchant of Carthagena, South America, deely interested in all that regards the statistics of New Grenada, Don Ignasio Pombo, wrote to me in the month of February, 1803: "Since you ascended the Rio Magdalena to Santa Fe and Quito, I have never ceased to take informations respecting the isthmus of Cupica. There are only from five to six leagues from that port to the embarcadere of Rio Naipi, and the whole territory is a plain, (*térreno enteraménte Llanos.*") From the facts I have mentioned, it cannot be doubted that this part of the northern Choco is of the highest importance for solving the problem under our consideration; but, in order to form a precise idea of this absence of mountains at the southern extremity of the isthmus of Panama, we must bear in mind the general outline of the Cordilleras.

The chain of the Andes is divided at the second and fifth degree of latitude into three chains, and the two longitudinal valleys that separate those chains form the basins of the Magdalena and the Rio Cauca.

The eastern branch of the Cordilleras inclines towards the north-east, and joins itself by the mountains of Pamplunes and Guita to the *Sierra Nevada de Merida*, and the chain of the coast of Venezuela, and the intermediate and western branches of Quindio and Choco run into one another, in the province of Antioquia, between the 5° and 7° of latitude, and form a group of mountains of considerable breadth, stretching by the *Valle de Osos*, and the *Alto del Viento*, towards Cazeres, and the elevated savannahs of Tolu.

Further west, in the *Choco del Norte*, the mountains lower to such a degree that, between the Gulf of Cupica and the Rio Naipi, they disappear altogether.

It is the astronomical position of that isthmus, and the distance from the mouth of the Atrato to its confluence with the Rio Naipi, that should be fixed with precision. We do not know whether sloops can ascend to this point.

After the lake of Nicaragua, Cupica, and Huasacualco, the isthmus of Panama merits the most serious attention.

The practicability of forming a canal for ship navigation depends, at the same time, on the height of the point of partition, and the configuration of the coasts; that is, on the maximum of their nearness to each other. So narrow a neck of land might, by its direction, have escaped the destructive influence of the current of rotation; and the supposition that the greatest height of the mountains must correspond to the minimum of the distance between the coasts, would not, in our days, be justified even by the principles of merely systematic geology.

Since I published my first work on the junction of the seas, we remain, unfortunately, in the same ignorance respecting the height of the ridge which the canal must pass over.

Two learned travellers, MM. Boussingault and Rivero, levelled the Cordilleras, from Caraccas to Pamplona, and from thence to Santa Fe de Bogota, with a precision superior to anything I could

attempt in that kind of research. But on the northwest of Bogota, from the Andes of Quindiu and Antioquia, levelled by M. Restrepo and myself, as far as the table land of Mexico, in the 12° of latitude of *Central America*, not one single measure of height has been made since my return to Europe. It is much to be regretted that, towards the middle of the last century, the French academicians crossed the isthmus of Panama without thinking of opening their barometer at the point of the partition of the waters. Some observations which Ulloa has repeated as by chance, have led me to conclude that, from the mouth of the Rio Chagres to the embarcadere of Cruces, there is a difference of level of 210 or 240 feet. From the Venta de Cruces to Panama, you ascend rapidly, and then descend during several hours towards the South sea. It is, therefore, between this port and Cruces that the threshold or point of partition is placed, which the canal must pass over, if the idea be persisted in of giving it that direction.

I shall here mention that it would suffice, in order to enjoy the view of the two oceans at once, that the mountains of the *line of elevation* in the isthmus were 580 feet high; that is, only a third higher than the Naurouse, in the chain of the Corbiéres, which is the point of partition of the canal of Languedoc. Now, this simultaneous view of the two seas is remarked in some parts of the isthmus as being very extraordinary; from which we may, I think, conclude that the mountains are in general not an hundred toises high. Some feeble indications of the temperature and geography of the native plants, lead me to think that the ridge over which the road passes from Cruces to Panama, is not 500 feet high. Mr. Robinson supposes it at most 400 feet. According to the assertion of a traveller, who describes with the most ingenuous simplicity what he has seen, the hills that compose the central chain of the isthmus are separated from each other by valleys, "which leave a free course to the passage of the waters." The researches of the engineers who are charged to explore those countries should be principally directed to the discovery of the transversal valleys. We find examples in every country of natural openings across the ridges. The mountains between the channels of the Saone and the Loire, which the canal of the centre would have had to pass over, were eight or nine hundred feet high. But a neck of land, or interruption of the chain, near the reservoir of Long Pendu, furnished a passage 350 feet lower. If we are not at all advanced in the knowledge of the heights of the isthmus of Panama, the last labors of M. Fidalgo, and other Spanish navigators, have at least furnished more precise statements on its configuration and the minimum of its breadth. This minimum is not 15 miles, as the first maps of the *deposito hydrografico* indicate, but 25¾ miles, (60 to a degree;) that is, 8⅝ marine leagues, or 24,500 toises; for the dimensions of the Gulf of San Blas, called also Ensenada de Mandinga, on account of the small river of that name which flows into it, have given rise to great errors. This gulf penetrates into the land 17 miles less than was supposed in 1805, in taking the plan of the Archipelago of the Islas Mulatas. Whatever credit the last

astronomical observations appear to merit, and on which the map of the isthmus is founded, published by the Royal Deposite of the Marine of Madrid, in 1817, we must not forget that these operations comprehend only the northern coast, which appears never yet to have been connected either by a chain of triangles, or chronometrically, (by the transport of time,) with the southern cost.

Now, the problem of the breadth of the isthmus does not solely depend on the determination of the latitude. The government of Columbia having lately received excellent barometers, constructed by M. Fortin, may direct the geodesic levellings, which are always slow and expensive, to be preceded by barometric levellings, which in the torrid zone are extremely exact. I am assured that in those countries correspondent observations may be dispensed with on account of the marvellous regularity of the horary variations, without fearing errors of 4 or 5 toises. The points which ought to be carefully examined are the following: the *isthmus* of *Huasacualco*, between the sources of the Rio Chimalapa and the Rio del Passo; the *isthmus* of *Nicaragua*, between the lake of that name and the insulated volcanoes of Granada and Bombacho; the *isthmus* of *Panama*, between the Venta de Cruces, or rather between the Indian village of Gorgona, 3 leagues below Cruces and the port of Panama, between the Rio Trinidad and the Rio Caymito, the bay of Mandinga and the Rio Juan Diaz; the Ensenada de Anachacuna (west of the Cape Tiburon) and the Gulf of San Miguel, in which the Rio Chuchunque or Tuyra loses itself; the *isthmus* of *Cupica*, between the coast of the South sea and the confluence of the Rio Naipi with the Rio Atrato; and, finally, the isthmus of Choco, between the Rio Quibdo, upper tributary stream of the Atrato, and the Rio San Juan de Charambira.

Persons accustomed to take accurate observations, if furnished only with barometers, instruments of reflection, and time keepers, might, in a few months, solve problems which, during centuries, have interested all the commercial nations of both worlds. If, in the enumeration of the countries which present advantages for the junction of the two seas, I have not passed over in silence the *isthmus* of *Choco*, that is the *platiniferous* soil extending from the river San Juan de Charambira to the Rio Quibdo, it is on account of its being the sole point on which a communication exists since the year 1788 between the Atlantic ocean and the South sea. The small canal of Raspadura, which a monk, the curate of Novita, caused to be dug by the Indians of his parish in a ravine periodically filled by natural inundations, facilitates the inland navigation on a length of 75 leagues, between the mouth of the Rio San Juan, below Noanama, and that of the Atrato, which bears also the names of the Rio Grande del Darien, Rio Dabeiba, and Rio del Choco. During the wars which preceded the revolution of Spanish America, considerable quantities of cacao of Guayaquil were conveyed this way to Carthagena. The canal of Raspadura, of which I believeI gave the first intimation in Europe, affords a passage only for small boats; but it might be easily enlarged if the streams were

joined to it known by the names of Cano de Las, Animas, Cano del Calichi, and Aguas Claras. *Feeding trenches* are easily established in a country like Choco, where it rains during the whole year, and where thunder is every day heard. The barometric observations of the unfortunate Caldas not having been published, we are ignorant of the height of the point of partition between San Pablo and the Rio Quibdo. We only know that there are some *gold washings* in these countries at the height of from 360 to 400 toises above the level of the ocean, and that they are never found at a lower elevation than 50 toises. The position of the canal in the interior of the continent, its great distance from the coast, and the frequent falls (raudalitos ychoreras.)

Of the rivers which it is necessary to ascend and descend, in order to pass from one sea to another, from the port of Charambira to the gulf of Darien, are obstacles too difficult to be overcome, in order to establish *a line of great navigation* across the Choco.. But that line, even without furnishing a passage for vessels of great tonnage, will not be less worthy of the attention of a wise administration; it will give life to inland trade between Carthagena and the province of Quito, and between the ports Santa Marta and Peru. We shall observe, at the close of this discussion, that the ministry of Madrid never enjoined the viceroy of Santa Fe to fill up the ravine of Raspadura, or to punish with death those who attempted to re-establish a canal at Choco, as has been asserted in a work recently published. This suspicious policy may indeed remind us of the order given to the viceroy of New Spain, during my stay in America, to root up the stocks of the vines in the *provincias internas;* but the hatred borne towards the culture of the vine in the colonies was owing to the influence of some merchants of Cadiz, who were jealous of what they called their ancient monopoly, while a small ravine that crosses the forests of Choco escaped more easily the vigilance of the ministry, and the jealousy of the mother country. After having examined the localities of the different points of partition, according to the imperfect information which I have hitherto been able to collect, it remains to prove, by the analogy of what men have executed in the state of modern civilization, the possibility of realizing the junction of the two oceans.

In proportion as problems become complicated, and depend on a great number of elements, by their nature variable, is the difficulty of fixing the *maximum* which the efforts of intelligence, and the physical power of nations, are capable of exerting. During the thousands of years that have elapsed from the unknown period of the construction of the pyramids of Ghizeh to that of our gothic steeples and the cupola of St. Peter's, men have not raised one edifice exceeding 450 feet in height; but shall we presume to conclude from this fact that modern architecture cannot go beyond an elevation scarcely equal to forty times that of the edifices constructed by white ants?

If the question here agitated respected only canals of a mean size, having a depth of only from three to six feet, and serving merely for inland navigation, I could mention canals, long since

executed, which pass over ridges of mountains, of from 300 to 580 feet high. England alone, of which the canals are 584 marine leagues in length, contains nineteen that cross the points of partition between the rivers of the western and eastern coast. Engineers have long so little regarded 580 feet, that is the height of the *bief* of division of Naurouse, on the canal of the south, as the *maximum* which may be reasonably attained in this kind of hydraulic construction, that Mr. Perronet, a man justly celebrated, considers the project as very practicable of forming a canal in Burgundy between the Yonne and the Saone, which must pass over a height (near Pouilly) of 921 feet above the level of the Yonne at low water. In combining inclined planes and railways with lines of navigation, boats have passed into the Monmouthshire canal at a thousand feet of elevation; but such works, so important for the prosperity of the inland trade of a country, do not constitute what may be called *canals for sea navigation.*

The discussion with which we are at present occupied regards the communication from sea to sea by vessels fitted, from their structure and tonnage, for the India and Chinese trade. Now, the industry of the nations of Europe presents two examples of these oceanic communications on a very great scale—one in the canal of the Eyder, or Holstein; the other in the Caledonian canal. The former of these works, constructed from 1777 to 1784, joins the Baltic with the North sea, between Kiel and Toningen, having only six locks, and passing over a bar of 28 feet. It separates the continental part of Denmark from Germany, and enables vessels of an ordinary size to avoid the dangerous passage of the Cattegat and the sound. It receives ships of from 140 to 160 tons, coming from the ports of Russia and Prussia, and going to England, the Mediterranean, Philadelphia, the Havannah, and the western coast of Africa. These vessels draw only from 8 to 10 feet of water. Being generally constructed in Holland, or in the Baltic, the ribs are very flat; and they are, consequently, spacious, without drawing much water. The Caledonian canal, not the most useful, but unquestionably the most magnificent hydraulic work hitherto undertaken, is an *oceanic canal* in the strictest sense of the term. It unites the eastern and western seas of Scotland, between Inverness and Fort William, in a neck of land across which nature seems to have traced the line of junction.

The navigable part is 17 leagues in length, (20 to a degree,) of which there are only 6¼ of artificial excavation; the remainder forms a natural navigation on the lakes of Oich and Lochy, separated heretofore by a rocky ridge. This canal was completed in the space of 16 years; admits the passage of frigates of 32 guns, and of large ships employed in foreign trade. Its mean depth is 18 feet 8 inches, (6.09m.,) and its breadth at the bottom 47 feet, (15.2m.) The locks, 23 in number, are 150 feet long and 37 feet wide.

Being guided in the practical views presented at the end of this chapter, only by the analogy of the labors already performed by man, I shall first observe that the breadth of the isthmuses of Cupica

and Nicaragua, in which the height of the ridge of partition is very inconsiderable, is nearly the same as the breadth of the land crossed by the artificial part of the Caledonian canal. The isthmus of Nicaragua, by the position of its inland lake, and the communication of that lake with the Atlantic, by the Rio San Juan, presents several features of resemblance with that neck of land in the Scotch highlands, where the river Ness forms a natural communication between the mountain lakes and the gulf of Murray. At Nicaragua, as in the Scotch highlands, there would be but one narrow ridge to pass over; for, if the Rio San Juan in a great part of its course is from 30 to 40 feet deep, as is asserted, it would only require to be rendered navigable in some parts by means of wears or lateral channels.

With respect to the depth of the oceanic canal projected in Central America, it might, I think, be even less than the depth of the Caledonian canal. Such is the change which the new systems of commerce and navigation have produced within 15 years in the capacity or the structure of the ships most commonly employed in the intercourse with India and China, that in examining with attention the official list of vessels which, during two years, from July 1821 to June 1823, have traded from London and Liverpool to these two countries, we find, on a total of 216 vessels, two-thirds below 600 tons, one fourth between 900 and 1,400 tons, and one-seventh below 400 tons. In France, the mean tonnage in the ports of Bordeaux, Nantes, and Havre, of vessels trading to India, is 350 tons.

The nature of the operations undertaken in the most distant latitudes, determines the capacity of the vessels employed; for instance, to bring indigo from Bengal, it may appear sufficient, and even preferable, to send a vessel of 150 to 200 tons.

The system of small expeditions is preferably adopted in America, where all the advantages are felt of prompt lading and a rapid circulation of capital. The average size of American vessels that go to India round the Cape of Good Hope, and to Peru round Cape Horn, is 400 tons; the whale-boats of the South sea are only 200 or 300 tons. In Spanish America, from ancient custom, ships of much greater tonnage are employed in time of peace. At Vera Cruz, for example, where there entered, during my stay in Mexico, from 100 to 130 vessels, coming from Spain, their size was generally 500 tons. It is only in time of war that shipments of 300 tons are made for Cadiz.

These statements sufficiently prove that, in the present commercial state of the world, such a canal of junction as is projected between the Atlantic ocean and the South sea, would be sufficiently large, if, by its section and the capacity of its locks, it could admit the passage of vessels of from 300 to 400 tons burden. This ought to be the *minimum* of its dimensions, and it supposes, after what we have indicated above, a capacity nearly double that of the canal of Holstein, but much less than that of the Caledonian canal; the former receiving vessels of from 150 to 180 tons, and the latter frigates of 32 guns, and merchant ships of more than

500 tons. It is true, that the tonnage determines only by approximation the quantity of water a ship draws, since the excellence or defects of its construction alters at the same time its speed and its capacity for storeage.

We may, however, admit that a mean depth of from 15½ to 17½ feet will suffice for a canal of junction intended for vessels of 300 to 400 tons; this is fifteen inches less than the celebrated engineers, Messrs. Rennie, Jessop, and Telford, have given to the Caledonian canal, and double that of the canal of the Forth and Clyde. The gigantic works of Europe which we have mentioned as examples, and the construction of which has not cost more than four millions of piastres, have had very small heights to pass over—less than from 90 to 100 feet. The canals which cross the ridges of partition of from three to six thousand feet, have been hitherto only from four to six feet. The difficulties naturally increases with the elevation of the ridge of partition, the depth of the excavations, and the size, if not the multiplicity of the locks. It is not enough to dig the canal; it must be ascertained that the quantity of water derived from the upper ground is equal to the demand for filling it; that is, sufficient to feed the canal, and to replace what is lost by the locks by evaporation and by filtration. We have seen above that the local circumstances in the isthmuses of Cupica and Huasacualco are such, that the obstacle to be overcome in effecting the junction of the seas, is less the height of the ridge which the canal must cross, than the state of the beds of the rivers (Naipi and Rio del Passo) which must be rendered navigable, either by being excavated by machines worked by a steam engine, or by wears and lateral derivations.

In the intendance of Nicaragua, the great depth of the Rio San Juan, and that of the Lake of Nicaragua, or *laguna de Granada*—which is, according to Mr. Robinson, from seventeen to forty, and according to Mr. Juarros, from twenty to fifty-five feet—seems to render such labors superfluous. The mountains of the isthmus of Panama rise probably to the elevation of the basins of partition of the *canal du centre* (between Châlons and Digoin) and of the grand junction canal, (between Brentford and Brownston.) The mountains of the isthmus may be still more elevated, and perhaps are divided by no transversal valley from south to north. We think that more advantageous spots may be chosen; but we ought here to observe, that the height of the ridge is an inseparable obstacle to the junction of seas only, when there is not at the same time a sufficient quantity of upper waters fit to be conveyed to the point of partition.

Seven or eight locks crowded together on the canals of Briare and Languedoc, and regulating falls of water of from 64 to 70 feet long, appeared an extraordinary work, notwithstanding the small dimensions of the locks and the depth of the canals, of which the section does not exceed five to six feet.

The *staircase of Neptune*, in the Caledonian canal, presents a similar accumulation of locks, on a scale so much more extensive, that frigates can rise in a small space of time to the height of sixty

feet. Now, that work only cost 257,000 piastres; that is, five times less than three pits of the mine of Valenciana, in Mexico; and ten *staircases of Neptune* would cause ships of 600 tons to pass over a ridge of partition 600 feet higher than the chain of the Corbières, between the Mediterranean and the Atlantic. I discuss here the possibility only of executing works to which there will certainly be no need to have recourse.

The expense of water for feeding a canal increases with the extent of the filtrations, the frequency of passages, or of the lockages, (*exclusee,*) and with the size of the chambers of locks, but not with their number. The facility of collecting an enormous mass of rain waters within the tropics is beyond what the engineers of Europe can imagine. When Louis XIV. ordered the gardens of Versailles to be embellished, Colbert was made to hope that the rains would furnish, on a surface of 12,700 hectares of plains which communicated with ponds and reservoirs, 9,000,000 of cubic toises of water. Now, the rains in the vicinity of Paris amount annually only to from 19 to 20 inches, while within the torrid zone, in the new world, above all in the region of the forests, the quantity is at least from 100 to 112 inches. This immense difference shows that, by the junction of the springs, by feeding trenches, and well established reservoirs, an able engineer might avail himself, in Central America, of circumstances which are wholly dependent upon the climate. Notwithstanding the high temperature of the air, the loss caused by evaporation will scarcely counterbalance, in deep basins, the advantages of the tropical rains.

The experiments made at the Pontinspar marshes by M. de Prony, and at the canal of Languedoc by MM. Pin and Clausade, indicate, in the latitudes 41° and 43½°, a produce of annual evaporation of 348 lines. The experiments which I made in the tropics are not sufficiently numerous to draw a general result; but in supposing the atmosphere equally calm in the south of France and the torrid zone, the mean heat of the year to be 15° and 27° cent., and the mean humidity expressed by the degrees of the hair-hygrometer 82° and 86°, I find, with M. Gay Lussac, that the evaporation of the two zones is in the relation of 1 to 1.6, while the quantity of rain water which the earth receives serves as 1 to 5. We must not either forget that canals lose by evaporation only in proportion to their own surface, while they collect the waters that fall on the vast extent of surrounding lands. In the volume of water which hydraulic works require, we must distinguish between that which depends on the capacity of the whole canal—that is, its length and section—and that which is determined by the locks, that is, by the lockage water of one sluice, or by the quantity of water which falls from the upper into the lower channel every time a vessel passes through a lock. These two volumes of water lose by evaporation and filtration; the latter, which it is very difficult to estimate, diminishes with time. The length and depth of an *oceanic canal* in the new world must, consequently, have an influence on the volume of water necessary to fill it at the beginning, when the excavations are just terminated, or after having shut up the sluices when re-

pairs are necessary; but the quantity of water which should feed the canal annually, after making allowance for the losses caused by the filtration and evaporation, depends on the number of the locks, or on the relation between the quantity of the *lockage water* of one lock and the activity of the navigation.

The heavier the tonnage of ships, the less frequent will be their passage. I dwell on these technical considerations to remove the apprehension of wanting a sufficient volume of water to feed a canal of considerable length, and if it be meant to serve at the same time for small boats filled for inland trade, locks of less dimensions might be added to the great *locks*, in order to economize the waters, which has been practised on the Grand Junction canal, and was projected for some time on the Caledonian canal. It appears somewhat probable that the province of Nicaragua will be fixed upon for the great work of the junction of the two oceans; and in that case it will not be necessary to form a line constantly navigable. The isthmus to be passed over is only from five to six marine leagues; there are some hills in the narrowest part, between the western bank of the lake of Nicaragua and the gulf of Papagayo; but it is formed of uninterrupted savannahs and plains, affording an excellent road for carriages (*camino ceratero*) between the town of Leon and the coast of Realexo.

The lake of Nicaragua is elevated above the South sea the height of the whole fall of the Rio San Juan, on a length of 30 leagues; and the position of this vast basin is so well known in the country that it was considered heretofore as an invincible obstacle to the project of a canal, from the fear of an impetuous flowing towards the west, or a diminution of the waters in the Rio San Juan, where, above the ancient Castello de San Carlos, are rapids that are dangerous in time of drought.

The art of engineering is sufficiently improved in our days to have no apprehension of such dangers.

The lake of Nicaragua may serve as an upper basin, like the lake Oich in the Caledonian canal, and regulating sluices will furnish only as much water for the canal as it requires. The small difference of level between the Atlantic and the Pacific oceans depends, as I have said elsewhere, only on the unequal height of the tides. The same difference is observed between the two seas that are joined by the great canal of Scotland; and if it were six toises, and constant like that of the Mediterranean and the Red Sea, it would not less favor the establishment of an oceanic junction. The winds blow with sufficient force on the lake of Nicaragua to render it unnecessary to tow the ships which pass from one sea to the other by means of steamboats; but the employment of the moving power of the steam would be of greatest utility in the passage from Realeo and Panama to Guayaquil, where, during the months of August, September, and October, calms alternate with winds that blow in a contrary direction. In stating my ideas on the junction of the two seas, I have calculated only on the most simple means, for the execution of so vast a project. Steam engines for feeding the basins of partition, subterraneous tunnels, as

they were proposed in the mountainous part of the isthmus of Panama, and like those of the canal of Saint Quentin, which has one of 2,900 toises in length, belong preferably to inland lines of navigation. It is sufficient for me to have shown the practicability of an oceanic canal in central America; the estimate of the expense of its construction, of the labor of clearing the ground, and forming banks, locks, basins, and feeding trenches, must depend on the choice of the localities. The Caledonian canal, the most admirable work hitherto executed, cost nearly 3,900,000 piastres, which is 2,700,000 piastres less than the canal of Languedoc, reducing the mark of silver to the present currency of money.

The sketch of the general expense of the works of the canal of Suez, projected by M. Le Pere, at the period of the expedition of Bonaparte to Egypt, amounted to five or six millions of piastres, of which a third would have belonged to the subsidiary canals of Cario and Alexandria. The isthmus of Suez, reckoning that part which has never been reached by the tides at 59,000 toises (more than 20 marine leagues) of breadth, and the projected canal, with four locks, might receive vessels during several months of the year, (while the risings of the Nile last,) drawing from 12 to 15 feet water. Now, in supposing that the canal for joining the seas in the new world were to occasion an equal expense with those of Languedoc, the highlands of Scotland, and Suez, I do not believe that this consideration would retard the execution of so great a work. The new world already furnishes examples of works no less considerable. The State of New York alone, has, in the space of six years, caused a canal to be dug between the lake Erie and the river Hudson, more than an hundred leagues long, of which the expense was estimated at nearly five millions of piastres, in a report addressed to the provincial legislature. When we consider in one view the gigantic works, little indeed to be praised, which have been executed within two centuries, for diminishing the waters of the lakes in the valley of Mexico, we conceive that with the same labor the isthmus of Nicaragua and Huasacualco might have been cut, perhaps even that of Panama, between Gorgona (on the Rio Chagres) and the coast of the South sea. In the year 1607 a subterraneous canal was dug 3,400 toises long, and 12 feet high, on the north of Mexico, on the other side of the hill of Nochistongo. The viceroy, Marquis of Solinas, passed along half its length on horseback. The open trench (tajo de Huehuetoca) which now leads the waters out of the valley, is 10,600 toises long, of which a considerable part is dug in a movable earth; it has 140 and 180 feet of perpendicular depth, and towards the upper part, is from 250 to 330 feet broad. The expense of these hydraulic works of the *Desague* of Mexico, amounted, from the year 1607 to the time when I visited them, in January, 1804, to the sum of 6,200,000 piastres. It is little to be apprehended that sufficient money would not be collected for opening an oceanic canal, when we recollect that the family of the Count de la Valenciana alone had the resolution to dig four shafts at Guanaxuato, which cost altogether more than 2,200,000 piastres. Even supposing that during a cer-

tain number of years the annual expense of the cut of the isthmus would amount to seven or eight hundred thousand piastres, that sum would be supported either by the undertakers or by the different States of America, of which the trade would derive inappreciable advantages from the opening of a new way towards Peru, the western coast of Quito, Gautemala, Mexico, Nutka, or the fur coast, and to China. With respect to the mode of execution, on which I have been recently consulted by well informed persons belonging to the new governments of equinoctial America, I believe that a joint stock association can only be formed when the practicability of an oceanic canal capable of receiving vessels of three or four hundred tons, between the latitudes of 7° and 18°, has been proved, and the ground fixed upon and recognized.

I shall abstain from discussing the question, "whether this ground should form a separate republic, by the name of Junctiana, dependent on the confederation of the United States," as it has been recently proposed in England, by a man whose intentions are always the most praiseworthy and disinterested. But whatever government may claim the soil on which the great junction canal of the ocean shall be established, the benefit of this hydraulic work ought to belong to every nation of both worlds, who shall have contributed to its execution by taking shares. The local governments of Spanish America can order surveys to be made on the spot, the levelling of the ridge of partition, the measure of the distances, the soundings of the lakes and rivers to be crossed, and the estimate of the springs and rain-waters proper to feed the upper basin.

These previous labors will require but a small expense, but must be executed according to a uniform plan at the isthmuses of Tehuantepec, or Hoazacoalcos, Nicaragua, Panama, Cupica, or Darien, and Raspadura, or Choco. When the plans and profiles of these five territories are placed before the public, the persuasion of the possibility of an oceanic junction will become more general in both continents, and will facilitate the formation of a joint stock company. A free discussion will show clearly the advantages and disadvantages of each locality, and will soon lead to the fixing on two, or, perhaps, on one sole point. The junction company will then submit the local circumstances to a second and more rigid examination; the expense will be estimated, and the execution of this important work confided to engineers who have practically engaged in executing similar works in Europe. As there seems to be no doubt that, in case of the impracticability of an *oceanic canal*, *canals of small section* might be dug in some of the five points we have named, to the great profit of the shareholders; it would, perhaps, be advantageous to make the first survey at the expense of an association. A ship might transport the engineers and their instruments successively to the mouth of the Atrato, Rio Chagres, the bay of Mandinga, Rio San Juan, the lake of Nicaragua, and the isthmus of Huasacualco, or Tehuantepec. The facility of the operations, and the appreciation of the advantages of the different spots of which the comparison is to be made, would gain in ce-

lebrity by this mode of a more uniform levelling; and the *association* of the first *survey*, after having fixed on the spot to be preferred, and the magnitude of the work, according to the tonnage of the ships or boats to be employed, would make an appeal to the public to augment the fund, and constitute an *association of execution*, either, as we have reason to hope, for a *canal of oceanic navigation*, or for canals or *lines of small navigation*. In adopting the mode of execution which I have just stated, all that prudence prescribes would be complied with in an affair that interests the commerce of both worlds. The *junction company* would find funds from governments and enlightened citizens, who, insensible to the allurements of gain, and yielding to noble impulses, would be proud of the idea of having contributed to a work worthy of modern civilization. It is also well to remember, in this place, that the attraction of gain, the fundamental basis of all financial speculations, is not illusory in the enterprise for which I warmly plead. The dividends of the companies in England, who have obtained the grant of opening canals, prove the utility of these enterprises, even for the shareholders. The tax of tonnage in a canal of junction of the seas may be so much more considerable, as the ships which profit from the new passage in going to the fishery of Lima, Cachelot, or to the northwest coast of America, and thence to Canton, would considerably shorten their way, and avoid the high southern latitudes, dangerous in the bad seasons. The activity of the passage would augment in proportion as traders became more familiarized with the new direction from one ocean to the other. Even if the dividends were insufficiently considerable, and the capitals placed in this enterprise did not bear the interest offered for the numerous loans made by governments, from the coast of the Mosquito Indians to the last confines of Europe, it would be the policy of the great States of Spanish America to give this enterprise their support, since it would be forgetting all that experience and political economy have taught for ages, to restrain the utility of canals and high roads to the duties paid by transports of merchandise, and to count for nothing the general influence exerted on industry and national prosperity. When we study attentively the history of the commerce of nations, we observe that the direction of the communications with India has not been changed solely according to the progress of geographical knowledge, or the improvement of the art of navigation; but that the change of the seat of civilization in the world has also powerfully contributed to this effect. From the time of the Phœnicians to that of the British empire, the activity of commerce has been carried progressively from east to west—from the eastern coast of the Mediterranean to the western extremity of Europe. If this change continues moving toward the west, which everything lead us to presume, the question on the preference given to the way to India by the southern extremity of Africa will no longer be such as it now is.

The canal of Nicaragua affords additional advantages to ships going from the mouth of the Mississippi, beyond what it promises to those which take in their lading on the banks of the Thames.

In comparing the different routes round the Cape of Good Hope, round Cape Horn, or across a cut of the isthmus of Central America, we must carefully distinguish between the objects of trade and the nations engaged in it. The problem respecting the way presents itself in a manner altogether different to an English merchant and to an Anglo-American, as the problem regarding Chili must be differently solved by those who trade directly with India and China, or those whose speculations are directed either towards northern Peru and the western coast of Guatemala and Mexico, towards China, after having visited the northwest coast of America, or towards the fishery of Cachelot, in the Pacific ocean. These three latter objects of the navigation of the nations of Europe and of the United States would be the most indubitably benefitted by the cutting of an American isthmus. From Boston to Nootka, the ancient centre of the fur trade in otter skins, on the northwest coast of America, across the projected canal of Nicaragua, will be 2,100 marine leagues; the same voyage is 5,200 leagues, if made, as it has been hitherto, by going round Cape Horn. These distances are from 3,000 to 5,000 leagues for a vessel going from London. From these statements, there results a shortening for the Americans of the United States of 3,100 leagues; and for the English, of 2,000 leagues; without including the chance of contrary winds, and the dangers of a navigation so different in the two ways, which we are contrasting. The comparison is much less favorable across Central America, with respect to space and time, for a direct trade with India and China.

From London to Canton, going round the Cape of Good Hope, and passing the equator twice, is usually a voyage of 4,400 leagues; from Boston to Canton, 4,500; if the canal of Nicaragua were dug, the length of the way would be 4,800 and 4,200 marine leagues.

Now, in the present improved state of navigation, the ordinary duration of a voyage from the United States, or from England, to China, round the extremity of Africa, is from 100 to 130 days. In founding the calculations on the analogy of the voyages from Boston and Liverpool to the coast of the Musquito Indians, and from Acapulco to Manilla, we find from 105 to 115 days for the voyage from the United States, or from England, to Canton, in remaining in the northern hemisphere, without once cutting the equator; that is, in taking advantage of the canal of Nicaragua, and the constancy of the trade winds in the calmest part of the Pacific ocean. The difference of time would therefore scarcely be a sixth; vessels could not return by the same way, but, in going, the navigation would be safer, at all seasons. A nation possessing fine settlements at the extremity of Africa and the Isle of France would, I believe, in general, prefer the passage from west to east.

The principal and real object of the opening of the isthmus is the prompt communication with the western coast of America, the voyage from the Havannah and the United States to Manilla—the expeditions made from England and the Massachusetts to the fur coast, (northwest coast,) or to the islands of the Pacific ocean, to visit afterwards the markets of Canton and Macao.

I shall add to these commercial considerations some political views, on the effects which the projected junction of the seas may produce. Such is the state of modern civilization, that the trade of the world can undergo no great changes that are not felt in the organization of society. If the project of cutting the isthmus that joins the two Americas should succeed, eastern Asia, at present insulated and secure from attack, will inevitably enter into more intimate connections with the nations of European race which inhabit the shores of the Atlantic. It may be said that that neck of land against which the equinoctial current breaks, has been for ages the bulwark of the independence of China and Japan. In penetrating farther into futurity, imagination dwells upon the conflict between powerful nations, eager to obtain exclusive advantages from the way opened to the commerce of the two worlds.

I confess I am not secured from that apprehension either by my confidence in the moderation of monarchical or of republican governments, or by the hope, somewhat shaken, of the progress of knowledge, and the just appreciation of human interests.

If I abstain from discussing political events that are so distant, it is to avoid flattering my readers with ideas of the free enjoyment of what yet exists only in the wishes of some men interested in the public good. The lake of Nicaragua and the Rio San Juan do not, as it has been affirmed in some ancient works, belong to the territory of New Grenada; the lake is separated from the Columbian territory of Veragua by Costa Rica, the most southern province of the ancient kingdom of Guatemala.

Placed in a country thinly peopled, especially towards the east, and almost on the confines of the two independent states of Central and Southern America, the great works which must be established for the junction of the two seas, will have no military defence but from Porto Bello and Carthagena, two fortresses to the windward of Castello de San Juan de Nicaragua. There is, indeed, a road by land from Guatemala to Leon; but the distance is more than 135 leagues. In the present state of things, it is less the strong places than the misery of the country, its want of culture, and the force of vegetation, which, from Darien to the 10th and 11th degrees of north latitude, have rendered unavailing the invasions of an enemy who disembarks suddenly on the eastern coast. In treating this important question, I cannot rest upon a more solid testimony than that of General Don José de Espeleta, who was viceroy of New Grenada till 1796.

This experienced officer, in a manuscript memoir which is addressed to his successor, the viceroy Don Pedro de Mendinueta, thus expresses himself on the defence of the isthmus of Panama: "Your excellency is informed that the king has caused his vast possessions in America to be visited by the Brigadier Cramer. That celebrated engineer has calculated the dangers to which we are still exposed, and indicated the fortifications which must be erected for defence. The isthmus of Panama is of the highest military importance, of which your excellency ought not to lose sight for one instant. Its importance is founded on its geographi-

eal configuration and its proximity to the South sea; it presents three points of defence—Porto Bello, and the small fort of San Lorenzo de Chagres towards the north, and the town of Panama towards the south. The heights which command Porto Bello render it impossible to fortify to any good purpose that poor and ill-peopled town; the batteries of San Fernando Santiago and San Geronimo, appear to me sufficient for defence of the port. The small fort of Chagres, at the mouth of the river of that name, is, in my opinion, the principal point of the isthmus, in the most natural supposition that the attack comes from the north; but neither the taking of Porto Bello nor the fort of San Lorenzo de Chagres, would determine the possession of the isthmus of Panama. The eal defence of that country consists in the difficulty which every considerable expedition will find in penetrating into the interior. On the southern coast, which is entirely unpeopled, this difficulty already exists for two or three insulated travellers."

Extract from Stephen's Central America, Chiapas, and Yucatan, volume 1, *chapter* 19.

I rose about an hour before daylight, and was in my saddle by break of day; we watered our mules at the river Flores, the boundary line of the States of Costa Rica and Nicaragua. In an hour we reached Skamaika, the name given to a single hut occupied by a negro, sick and alone. He was lying on a bedstead made of sticks, the very picture of wretchedness and desolation, worn to a skeleton by fever and ague. Soon after, we came to another hut, where two women were sick with fever. Nothing can be more wretched than these huts along the Pacific. They asked me for remedios, and I gave them some quinine, but with little hope of their ever benefiting by it. Probably both they and the negro are now in their graves.

At twelve o'clock we reached the river St. John, the mouth of which was the terminating point of the great canal. The road to Nicaragua crossed the stream, and ours followed it to the sea, the port being situated at its mouth. Our whole road had been desolate enough, but this far surpassed anything I had seen; and as I looked at the little path that led to Nicaragua, I felt as if we were leaving a great highway. The valley of the river is about a hundred yards broad, and in the season of rain the whole is covered with water; but at this time the stream was small, and a great part of its bed dry. The stones were bleached by the sun, and there was no track or impression which gave the slightest indication of a path. Very soon this stony bed became contracted and lost; the stream ran through a different soil, and high grass, shrubs, and bushes grew luxuriantly up to its bank. We searched for the track on both sides of the river, and it was evident that since the last wet season no person had passed. Leaving the river, the bushes were higher than our heads, and so thick that at every two or three paces I became entangled and held fast; at length I dismounted, and my guide cleared a way for me on foot with his machete. Soon we reached the stream again, crossed it, and entered the same dense mass on the opposite side. In this way we continued nearly two hours, with the river for our line. We crossed it more than twenty times, and when it was shallow rode in its bed. Farther down, the valley was open, stony, and barren, and the sun beat upon it with prodigious force; flocks of sopilotes or turkey buzzards, hardly disturbed by our approach, moved away on a slow walk, or with a lazy flap of the wings rose to a low branch of the nearest tree. In one place a swarm of the ugly birds were feasting on the carcass of an alligator. Wild turkeys were more numerous than we had ever seen them before, and so tame that I shot one with a pistol. Deer looked at us without alarm, and on each side of the valley large black apes walked on the tops of the trees, or sat quietly in the branches looking at us. Crossing the river for the last time, which became broader and deeper until it emptied into the Pacific,

we entered the woods on the right, and reached the first station of Mr. Bailey, but it was covered with young trees and bushes; the woods were thicker than before, and the path entirely undistinguishable. I had read reports, papers, and pamphlets on the subject of the great canal, and expected at least to find a road to the port; but the desert of Arabia is not more desolate, and the track of the Children of Israel to the Red sea, a turnpike compared with it.

My beautiful grey, degraded into a cargo-mule, chafed under her burden; and here obstructed, and jerked first one way and then the other, the girths of the saddle became loose, the load turned on her side, and she rushed blindly forward, kicking, and threw herself among the bushes. Her back was badly hurt, and she was desperately frightened; but we were obliged to re-load her, and, fortunately, we were near the end of our day's journey.

On the border of the woods we reached a stream, the last at which fresh water was procurable, and, filling our calabash, entered a plain covered with high grass. In front was another piece of woodland, and on the left the river San Juan, now a large stream, emptying into the Pacific. In a few minutes we reached a small clearing so near the shore that the waves seemed breaking at our feet. We tied our mules under the shade of a large tree on the edge of the clearing. The site of Mr. Bailey's rancho was on an eminence near, but hardly a vestige remained; and, though it commanded a fine view of the port and the sea, it was so hot, under the afternoon sun, that I fixed our encampment under the large tree. We hung our saddles, saddle cloths, and arms upon its branches, and while Nicolas and José gathered wood and made a fire, I found, what was always the most important and satisfactory part of the day's journey, excellent pasture for the mules.

The next thing was to take care of ourselves. We had no trouble in deciding what to have for dinner. We had made provision, as we supposed, for three days; but, as usual, it always happened that, however abundant, it did not last more than one. At this time all was eaten up by ourselves or by vermin; and, but for the wild turkey, we should have been obliged to dine upon chocolate. It was a matter of deeply interesting consideration how the turkey should be cooked. Boiling it was the best way; but we had nothing to boil it in except a small coffee pot. We attempted to make a gridiron of our stirrups and broil it; but those of Nicolas were wooden, and mine alone were not large enough. Roasting was a long and tedious process; but our guide had often been in such straits; and, fixing in the ground two sticks, with crotches, he laid another across, split open the turkey, and securing it by sticks crosswise, hung it like a spread eagle before a blazing fire. When one side was burned, he turned the other. In an hour it was cooked; and in less than ten minutes eaten up. A cup of chocolate, heavy enough to keep it from rising, if it had been eaten with its wings on, followed, and I had dined.

Rested and refreshed, I walked down to the shore. Our encampment was about in the centre of the harbor, which was the finest

I saw on the Pacific. It is not large, but beautifully protected, being almost in the form of the letter U. The arms are high and parallel, running nearly north and south, and terminating in high, perpendicular bluffs. As I afterwards learned from Mr. Bailey, the water is deep; and under either bluff, according to the wind, vessels of the largest class can ride with perfect safety. Supposing this to be correct, there is but one objection to this harbor, which I derive from Captain D'Yriarte, with whom I made the voyage from Zonzonate to Caldera. He has been nine years navigating the coast of the Pacific, from Peru to the Gulf of California, and has made valuable notes, which he intends publishing in France; and he told me that during the summer months, from November to May, the strong north winds, which sweep over the lake of Nicaragua, pass with such violence through the Gulf of Papajayo, that during the prevalence of these winds it is almost impossible for a vessel to enter the port of San Juan. Whether this is true to the extent that Captain D'Yriarte supposes, and, if true, how far steam-tugs would answer to bring vessels in against such a wind, is for others to determine. But at the moment there seemed more palpable difficulties.

I walked along the shore down to the estuary of the river, which was here broad and deep. This was the proposed termination of the great canal to connect the Atlantic and Pacific oceans. I had read and examined all that had been published on this subject in England or this country; had conferred with individuals; and I had been sanguine, almost enthusiastic, in regard to this gigantic enterprise; but on the spot, the scales fell from my eyes. The harbor was perfectly desolate; for years not a vessel had entered it; primeval trees grew around it; for miles there was not a habitation. I walked the shore alone. Since Mr. Bailey left, not a person had visited it; and probably the only thing that keeps it alive even in memory, is the theorizing of scientific men, or the occasional visit of some Nicaragua fisherman, who, too lazy to work, seeks his food in the sea. It seemed preposterous to consider it the focus of a great commercial enterprise; to imagine that a city was to rise up out of the forest; the desolate harbor to be filled with ships, and become a great portal for the thoroughfare of nations. But the scene was magnificent. The sun was setting, and the high western headland threw a deep shade over the water. It was perhaps the last time in my life that I should see the Pacific; and in spite of fever and ague tendencies, I bathed once more in the great ocean.

It was after dark when I returned to my encampment. My attendants had not been idle; blazing logs of wood, pliled three or four feet high, lighted up the darkness of the forest. We heard the barking of wolves, the scream of the mountain cat, and other wild beasts of the forests. I wrapped myself in my poncha, and lay down to sleep.

Nicolas threw more wood upon the burning pile; and, as he stretched himself on the ground, hoped we would not be obliged to pass another night in this desolate place.

In the morning I had more trouble. My gray mule, running loose, and drinking at every stream, with her girths tight, had raised a swelling eight or ten inches. I attempted to put the cargo on my macho, with the intention of walking myself; but it was utterly impossible to manage him, and I was obliged to transfer it to the raw back of the cargo mule.

At seven o'clock we started, recrossed the stream at which we had procured water, and returned to the first station of Mr. Bailey. It was on the river San Juan, a mile and a half from the sea. The river here had sufficient depth of water for large vessels, and from this point Mr. Bailey commenced his survey to the lake of Nicaragua. I sent Nicholas with the mules by the direct road, and set out with my guide to follow, as far as practicable, his line of survey. I did not know, until I found myself in this wilderness, how fortunate I had been in securing this guide. He had been Mr. Bailey's pioneer in the whole of his exploration. He was a dark Mestitzo, and gained his living by hunting bee trees and cutting them down for the wild honey, which made him familiar with all the water courses and secret depths of almost impenetrable forests. He had been selected by Mr. Bailey out of all Nicaragua; and, for the benefit of any traveller who may feel an interest in this subject, I mention his name, which is José Dionisio de Lerda, and he lives at Niçaragua.

It was two years since Mr. Bailey had taken his observations; and already, in that rank soil, the clearings were overgrown with trees twelve or fifteen feet high. My guide cleared a path for me with his machete; and, working our way across the plain, we entered a valley which ran in a great ravine called Quebrada Grande, between the mountain ranges of Zebadea and El Platina. By a vigorous use of the machete, I was enabled to follow the line of Mr. Bailey up the ravine to the station of Panama, so called from a large Panama tree near which Mr. Bailey built his rancho. Up to this place, manifestly, there could be no difficulty in cutting a canal; beyond, the line of survey follows the small stream of El Cacao for another league, when it crosses the mountain; but there was such a rank growth of young trees that it was impossible to continue without sending men forward to clear the way. We therefore left the line of the canal, and crossing the valley to the right, reached the foot of the mountain over which the road to Nicaragua passes. A path had been opened for carrying Mr. Bailey supplies to that station, but it was difficult to find it. We took a long draught at a beautiful stream called Loco de Agua, and my guide pulled off his shirt and commenced with his machete. It was astonishing how he found anything to guide him, but he knew a tree as the face of a man. The side of the mountain was very steep, and besides large trees, was full of brambles, thorn bushes and ticks. I was obliged to dismount and lead my macho; the dark skin of my guide glistened with perspiration, and it was almost a climb till we reached the top.

Coming out into the road, the change was beautiful. It was about ten feet wide, straight, and shaded by the noblest trees in

the Nicaragua forests. In an hour we reached the voca of the mountain, where Nicolas was waiting with the mules under the shade of a large tree, which threw its branches fifty feet from its trunk, and seemed reared by a beneficent hand for the shelter of a weary traveller. Soon we reached another station of Mr. Bailey. Looking back, I saw the two great mountain ranges, standing like giant portals, and could but think what a magnificent spectacle it would be to see a ship, with all its spars and rigging, cross the plain, pass through the great door, and move on to the Pacific. Beyond, the whole plain was on fire; the long grass, scorched by the summer's sun, crackled, flashed, and burned like powder. The road was a sheet of flame, and when the fire had passed the earth was black and hot. We rode some distance on the smoking ground along the line of flame, and finding a favorable place, spurred the mules through; but part of the luggage took fire, my face and hands were scorched, and my whole body heated.

Off from the road, on the edge of the woods, and near the river Las Lahas, was another station of Mr. Bailey. From that place the line runs direct over a plain till it strikes the same river near the lake of Nicaragua. I attempted to follow the lines again, but was prevented by the growth of underwood.

It was late in the afternoon, and I hurried on to reach the Camino Real. Beautiful as the whole country had been, I found nothing equal to this two hours before entering Nicaragua. The fields were covered with high grass, studded with noble trees, and bordered at a distance by a dark forest; while in front, high and towering, of a conical form, rose the beautiful volcano of the island. Herds of cattle gave it a home like appearance.

Toward dark we again entered the woods, for an hour saw nothing, but at length heard the distant sound of the vesper bell, and very soon were greeted by the barking of dogs in the suburbs of Nicaragua. Fires were burning in the streets, which served as kitchens for the miserable inhabitants, and at which they were cooking their suppers. We passed round a miserable plaza, and stopped at the house of the Licenciado Pineda. A large door was wide open; the licenciado was swinging in one hammock, his wife and a mulatto woman in another. I dismounted and entered his house, and told him that I had a letter to him from Don Manuel de Aguila. He asked me what I wished, and when I told him a night's lodging, said that he could accommodate me, but had no room for the mules. I told him that I would go to the cura, and he said that the cura could do no better than he. In a word, his reception of me was very cool. I was indignant, and went to the door, but without it was dark as Erebus. I had made a long and tiresome journey through a desolate country, and that day had been one of extreme labor. The first words of kindness came from the lady of the licenciado. I was so tired that I was almost ready to fall; I had left San José with the fever and ague, had been twelve days in the saddle, and the last two nights I had slept in the open fields. I owe it to both, however, to say, that, the ice once broken, they did all they could for my comfort; and in fact, treated me with

distinguished attention. A traveller never forgets the kindness shown him in a strange land, and I never felt so sensible of it as in Central America; in other countries, with money, a man can command comforts; there, whatever his means may be, he is entirely dependant upon individual hospitality.

The whole of the next morning I devoted to making inquiries on the subject of the canal route. More is known of it in the United States than at Nicaragua. I did not find one man who had been to the port of San Juan, or even who knew Mr. Bailey's terminating point on the lake of Nicaragua. I was obliged to send for my old guide, and after a noonday dinner started for the lake. The town consisted of a large collection of straggling houses, without a single object of interest. Though the richest state in the confederacy in natural gifts, the population is the most miserable.

Passing through the suburbs, very soon we entered the woods, and rode under a beautiful shade. We met no more. Before reaching the lake, we heard the waves breaking upon the shore like the waves of the sea; and when we emerged from the woods, the view before us was grand. On one side, no land was visible; a strong north wind was sweeping over the lake, and its surface was violently agitated; the waves rolled and broke upon the shore with solemn majesty, and opposite, in the centre of the lake, were the islands of Isola and Madeira, with giant volcanoes rising as if to scale the heavens. The great volcano of Omotepeque reminded me of Mount Etna, rising, like the pride of Sicily, from the water's edge, a smooth unbroken cone, to the height of nearly six thousand feet.

We rode for an hour along the shore, and so near the water that we were wetted by the spray. The bank was all wooded; and in one place, on a little clearing by the side of a stream, was a hut occupied by a mulatto, the view from which princes might envy. Farther on, we passed some women washing; and at a distance of a league and a half, reached the river Las Lahas, according to Mr. Bailey's survery, the terminating point on the lake. A flock of wild fowl were sitting on the water, and long-legged birds, with wings outstretched, were walking on the shore.

I had now examined, as well as circumstances would permit, the canal route from the Pacific to the Lake of Nicaragua. A direction had been given to my investigations by getting on the track of Mr. Bailey's survey; but I should be able to communicate nothing, if it were not for Mr. Baily himself, whom I afterwards met at Grenada. This gentleman is a half pay officer in the British navy. Two years before, he was employed by the government of Central America to make a survey of this canal route, and he had completed all, except the survey of an unimportant part of the river San Juan, when the revolution broke out. The States declared their independence of the general government, and disclaimed all liability for its debts. Mr. Bailey had given his time and labor, and, when I saw him, had sent his son to make a last appeal to the shadow of the federal government; but, before he reached the capital this government was utterly annihilated and

Mr. Bailey remains with no reward for his arduous services, but the satisfaction of having been a pioneer in a noble work. On my arrival at Grenada, he laid before me all his maps and drawings, with liberty to make what use of them I pleased. I passed an entire day in taking notes and memoranda, and receiving explanations, and the result of the whole is as follows:

The measurements began on the side of the Pacific ocean, and were carried over to the Lake of Nicaragua. The chain was twenty-five varas in length, each vara being thirty-two and a half inches English; and I give the levels as taken from Mr. Bailey's survey:

At a distance of

Chains.	Elevation in English feet.
17.50	8.93
34.37	12.04
52.38	7.99
67.50	16.82
80.95	26.90
103.06	38.12
120.07	52.62
134.94 La Desperansedera de la Quebrado la Palma. Boring, 3½ feet loose sand; 66 feet clay not very firm	66.12
149.61	76.12
164.71	94.66
185.34	132.95
201.50 Panama, water on the surface. Boring 11 feet, gravel; 24 feet 5 inches, slate stone.	201.50
221.87	223.00
226.14	214.235
235.48	241.35
253.63 first limestone *rock*	284.20
264.28	356.770
273.18	389.700
280.26	425.95
287.01	461.525
288.97	519.391
292.99 top of the Palma, and summit level. Boring 5 feet, yellow clay; 59 feet, stone, soft and loose. No water	615.673
299.05	570.157
300.53 second limestone rock	506.300
314.11	460.891
317.05	442.858
319.27	443.859
332.25	410.524
336.92 to this point national lands	393.216
340.28 third limestone rock. Boring 31½ feet, water; 49 feet, limestone, soft and loose	350.776
358.50	311.152
361.40	318.235

Chains.	Elevation in English feet.
370.55	291.419
373.85	295.160
382.86	283.352
401.04	269.236
409.30	258.378
413.51	261.486
423.75 water on the surface. Boring 3 feet, sand; 12 feet, earth	247.780
437.55	237.570
448.90	250.370
464.78	228.237
477.76	214.695
489.29	200.530
Between this and next, boring 5 feet, earth; 10 feet, white clay; 11 feet, water; 38 feet, soft stone.	
506.22	184.511
510.53	186.869
519.47	180.244
533.04	170.161
543.25	159.311
545.98	160.411
553.85	158.736
In the next six stations, the elevations do not differ one foot.	
604.82	153.461
612.62	160.077
622.54 water on the surface. Boring 12 feet, sand and hard stone. This station is in a hole of the Quebrado, very deep.	149.553
627.27	150.052
630.32	149.336
634.20	157.102
638.86	147.044
643.31	154.785
685.55	143.343
661.35	155.076
664.47	140.243
671.22	151.185
675.86	139.352
685.93	150.927
692.55	146.977
696.91	148.569
712.85	144.436
716.17	149.152
723.29	142.994
728.29	148.552
739.95	139.702
749.10	164.390
756.40	142.560

Chains.	Elevation in English feet
760.80	144.830
766.80	141.177
770.61 water at 8 feet. Boring 12 feet, black earth; 22 feet, white clay; 4 feet, stone	142.718
774.73	140.560
779.49	142.743
805.50	138.485
808.31 water on the surface. Boring 5 feet, sand; 15 feet, stone	124.310
812.01	139.152
828.77	133.802
832.24	134.377
837.43	130.994
841.76	129.486
846.45	129.994
In six stations, there is a difference of but from one to two feet.	
880.12 water on the surface. Boring 9 feet, loose sand; 18 feet, soft stone	126.569
887.23	107.553
891.96	123.903
901.22	118.112
910.80	120.628
In four stations, there is a difference of but one foot.	
933.74 Boring 8 feet, black earth; 10 feet, white mud; 18 feet, soft stone.	
957.62	117.178
971.48	108.802
976.30	135.168
986.06	107.643
992.93	119.176
1001.03	108.576
1006.65	118.592
1014.28	108.692
1033.51	124.808
1036.44	126.630
1043.06	141.416
1047.39	157.583
1062.87	118.042
1068.43	131.942
1077.69	120.584
1083.96	125.784
1100.19	135.709
1113.35	152.176
1128.97	127.201
1133.79	163.276
1140.94	129.776
1145.18	151.401
1156.44	129.335

Chains.	Elevation in English feet.
1176.61	140.835
1190.87	129.396
1193.77	132.801
1203.21	128.093
1210.14	140.985
1223.50	128.243

The result of the whole is as follows: The length from the Pacific to the Lake of Nicaragua is 28,365⅔ yards, or 15⅔ miles.

	Feet in dec.
The sum of the ascents is	10475.45
The sum of the descents is	9192.4
The difference is the height of the lake above the Pacific ocean at low water	1283.05

We now come to the communication with the Atlantic by means of the Lake of Nicaragua and the river San Juan. The lake is ninety-five miles long, in its broadest part about thirty, and averages, according to Mr. Bailey's soundings, fifteen fathoms of water. The length of the river, by measurement with all its windings, from the mouth of the lake to the sea, is seventy-nine miles. There are no cataracts or falls; all the obstructions are from rapids, and it is at all times navigable, both up and down, for piraguas drawing from three to four feet of water.

From the lake to the river of Los Savalos, about eighteen miles, the depth is from two to four fathoms. Here commence the rapids of Toros, which extend one mile, with water from one and a half to two fathoms. The river is then clear for four miles, with an average depth of from two to four fathoms. Then come the rapids of the old castle, but little more than half a mile in extent, with water from two to four fathoms; the river is clear again for about two miles, with water from two and a half to five fathoms, where begin the rapids of Nico and Las Balas, connected and running into each other, and both together not more than a mile, with water from one to three fathoms. Then the river is clear one mile and a half to the rapids of Machuca, which extend a mile, and, the worst of all, the water being more broken, from running over a broken rocky bottom. The river then runs clear and without any obstruction for ten miles, with water from two to seven fathoms, to the river San Carlos, and then eleven miles, with some islands interspersed, with water from one to six fathoms, to the river Serapequea, the measurements of one fathom being about the points or bends, where there is an accumulation of sand and mud. It then continues seven miles clear, with water from two to five fathoms, to the Rio Colorado. The river Colorado runs out of the San Juan in another direction into the Atlantic. The loss to the latter, according to measurement taken in the month of May, 1839, was twenty-eight thousand one hundred and seventy-eight cubic yards of water per minute, and in the month of July, of the same year, during the rising of the waters, it was eighty-five thousand eight hundred and forty yards per minute, which immense body might be saved to the San Juan by damming up the

mouth of the river Colorado. From this point there are thirteen miles with soundings of from three to eight fathoms. The bottom is of sand and mud, and there are many small islands and aggregations of sand without trees, very easily cleared away. The last thirteen miles might be reduced to ten by restoring the river to its old channel, which has been filled up by collections, at points, of drifted matter. An old master of a piragua told Mr. B. that, within his memory, trees grew half a mile back. The soundings were all taken with the plotting-scale when the river was low, and the port of San Juan, though small, Mr. Bailey considers unexceptionable.

The foregoing memoranda were placed in the hands of my friend, Mr. Horatio Allen, (now engaged as an engineer on our Croton aqueduct,) who has kindly prepared from them the plan opposite.

I ought, perhaps, to remark, for the benefit of those who are not familiar with such plans, that, in order to bring the profile of the country within a small compass, the vertical lines, which represent elevations and depressions, are on a scale many times greater than the base lines or horizontal distances. Of the former, the scale is one thousand feet, and of the latter it is twenty miles to the inch. This, of course, gives a distorted view of the country, but, to preserve the relative proportions, it would be necessary for the base line in the plan to be one thousand times longer.

The whole length of the canal from the lake of Nicaragua to the Pacific is fifteen and two-third miles. According to the plan, in the first eight miles from the lake, but one lock is necessary. In the next mile sixty-four feet of lockage are required. In the next three miles there are about two of deep cutting and one of tunnel, and then a descent of two hundred feet in three miles by lockage to the Pacific.

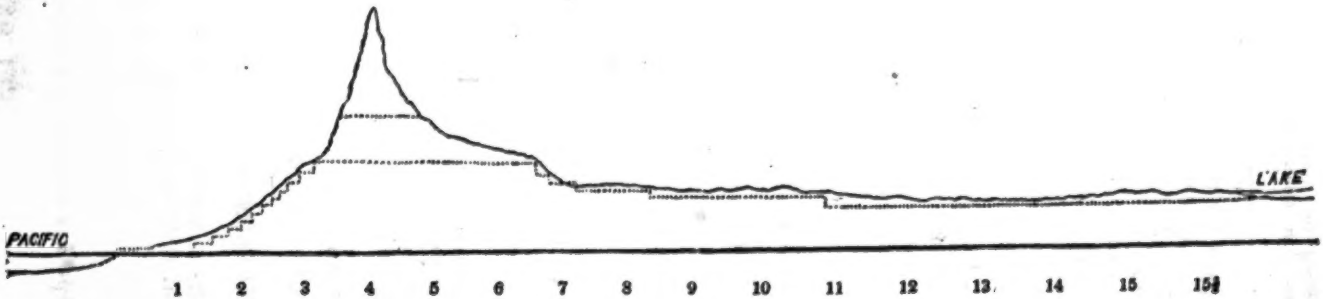
Thus far of the canal across the isthmus. The lake of Nicaragua is navigable for ships of the largest class down to the mouth of the river San Juan. This river has an average fall of one and six-sevenths feet per mile to the Atlantic. If the bed of the river cannot be cleared out, a communication can be made either by lock and dam, or by a canal along the bank of the river. The latter would be more expensive, but on account of the heavy floods of the rainy reason it is preferable.

I am authorized to state that the physical obstructions of the country present no impediment to the accomplishment of this work. A canal large enough for the passage of boats of the usual size could be made at a trifling expense. A tunnel of the length required is not considered a great work in the United States. According to the plan of the Chesapeake and Ohio canal, a tunnel is contemplated upward of four miles in length. The sole difficulty is the same which would exist in any route in any other region of country, viz: the great dimensions of the excavation required for a ship canal.

The data here given are, of course, insufficient for great accuracy; but I present a rough estimate of the cost of this work, furnished me with the plan. It is predicated upon the usual contract prices in the United States, and I think I am safe in saying that

From Pacific ocean to Lake, 15 2 3 miles.

River San Juan, 70 miles.



the cheapness of labor in Nicaragua will equalize any advantages and facilities that exist here.

The estimate is—

From the lake to the east end of the tunnel, from	$8,000,000 to 10,000,000
Descent to the Pacific	2,000,000 to 3,000,000
From the lake to the Atlantic, by canal along the bank of the river	10,000,000 to 12,000,000
	$20,000,000 to 25,000,000

which is about the sum contemplated as the cost of our enlarged Erie canal.

The idea of a communication between the Atlantic and Pacific is not new. Columbus wore out the last days of his checkered life in searching for a natural passage, and the vastness and sublimity of the enterprise suited the daring imagination of the early Spaniards.

From the formation of the continent, and the falling off in height of the range of the Andes, it has ever since engaged the attention of reflecting men. Even during the death-like sleep of Spanish dominion, a survey was made under the direction of the captain-general; but the documents remained buried in the archives of Guatemala until the emancipation of the colonies, when they were procured and published by Mr. Thompson, who visited that country under a commission from the British government.*

In 1825, an envoy extraordinary from the new republic of Central America called to it the special attention of our government, requesting our co operation in preference to that of any other nation, and proposed by means of a treaty, "effectually to secure its advantages to the two nations."

A chargé d'affaires was appointed by our government, who was specially instructed to assure the government of Central America of the deep interest taken by that of the United States, in the execution of an undertaking "so highly calculated to diffuse an extensive influence on the affairs of mankind," and to investigate with the greatest care the facilities offered by the route, and to remit the information to the United States.

Unfortunately, being far removed from the capital, none of our diplomatic agents ever visited the spot; but, in 1826—as appears by documents accompanying the report of a committee of the House of Representatives, on a memorial "praying the aid of the government of the United States in procuring the construction of a ship channel, or navigable canal, across the isthmus, between North and South America—a contract was made by the government of Central America with the agent of a New York company, under the name, style, and designation of the "Central American and United States

* Thompson's Guatemala. By this survey the work appears much more easy than by Mr. Bailey's, but it purports to have been taken by the water-level. Mr. Bailey knew of its existence, and had been the means of procuring it for Mr. Thomson.

Atlantic and Pacific Canal Company." The name of De Witt Clinton, and others of the most distinguished men of that day appear as associates, but the scheme fell through.

In 1830, the government of Central America made another contract with a society of the Netherlands, under the special patronage of the king of Holland, who embarked in it a large amount of his private fortune; but, owing to the difficulties between Holland and Belgium, and the separation of the two countries, this also fell through.

On the third day of March, 1835, a resolution passed the Senate of the United States, "that the President be requested to consider the expediency of opening negotiations with the governments of other nations, and particularly with the governments of Central America and Grenada, for the purpose of effectually protecting, by suitable treaty stipulations with them, such individuals or companies as may undertake to open a communication between the Atlantic and Pacific oceans, by the construction of a ship canal across the isthmus which connects North and South America, and of securing forever, by such stipulations, the free and equal right of navigating such canal to all nations, on the payment of such reasonable tolls as may be established, to compensate the capitalist who may engage in such undertaking and complete the work."

Under this resolution a special agent was appointed by General Jackson, who was instructed to proceed without delay, by the most direct route, to port San Juan; ascend the river San Juan to the lake of Nicaragua; and thence, by the contemplated route of communication by canal or railroad, to the Pacific ocean. After having completed an examination of the route of the canal, he was directed to repair to Gautemala, the capital of that republic, and with the aid of Mr. De Witt, the chargé d'affaires of the United States, procure all such public documents connected with the subject as might be had, and especially copies of all such laws as may have been passed to incorporate companies to carry into effect the undertaking of any convention, or conventions, that may have been entered into with a foreign power upon the subject, and of any plans, surveys, or estimates in relation to it. From Gautemala, he was directed to proceed to Panama, and make observations and inquiries relative to the proposed connexion of the two oceans at that point. Unfortunately, from the difficulty of procuring a conveyance to the river San Juan, the agent went to Panama first, from adverse circumstances never reached Nicaragua, and died on his return to this country, before he reached Washington; but, from his imperfect report, it appears to be result of his observations that a ship canal was not practicable across the isthmus of Panama. It is, therefore, valuable as turning attention, which was before divided between the two routes, exclusively to that by the lake of Nicaragua. In regard to this route, much has been written, many speculations, and even estimates of the cost of constructing the canal, have been made; but the actual knowledge on the subject has been very limited. In fact, the foregoing notes from Mr. Bailey's survey are the most reliable data that have

ever been published. I can but hope that the same liberal spirit which prompted the sending out of an agent, may induce our government to procure from Mr. Bailey, and give to the world, the whole of his maps and drawings.

As yet, the subject of this communication has not taken any strong hold upon the public mind. It will be discussed, frowned upon, sneered at, and condemned, as visionary and impracticable. Many in established business will oppose it, as deranging the course of their trade. Capitalists will not risk their money in an unsettled and revolutionary country. The pioneers will be denounced and ridiculed, as Clinton was when he staked his political fortunes upon the "big ditch" that was to connect the Hudson with Lake Erie; but, if the peace of Europe be not disturbed, I am persuaded that the time is not far distant when the attention of the whole civilized and mercantile world will be directed towards it; and steamboats will give the first impulse. In less than a year, English mail-boats will be steaming to Cuba, Jamaica, and the principal ports of Spanish America, touching once a month at San Juan and Panama. To men of leisure and fortune, jaded with rambling over the ruins of the Old World, a new country will be opened. After a journey on the Nile, a day in Petra, and a bath in the Euphrates, English and American travellers will be bitten by moschetoes on the lake of Nicaragua, and drink champagne and Burton ale on the desolate shores of San Juan, on the Pacific. The random remarks of the traveller for amusement, and the observations of careful scientific men, will be brought together—a mass of knowledge will be accumulated and made public, and in my opinion the two oceans will be united.

In regard to the advantages of this work I shall not go into any details; I will remark, however, that on one point there exists a great and very general error. In the documents submitted to Congress, before referred to, it is stated that "the trade of the United States and Europe with China, Japan, and the Indian Archipelago, would be facilitated and increased by reason of shortening the distance above four thousand miles;" and in that usually correct work, the Modern Traveller, it is stated that from Europe "the distance to India and China would be shortened more than 10,000 miles;" but by measurement on the globe, the distance from Europe to India and China will not be shortenened at all. This is so contrary to the general impression that I have some hesitation in making the assertion; but it is a point on which the reader may satisfy himself by referring to the globe. The trade of Europe with India and Canton, then, will not necessarily pass through this channel from any saving of distance; but, from conversations with masters of vessels and other practical men, I am induced to believe that, by reason of more favorable latitudes for winds and currents, it will be considered preferable to the passage by the Cape of Good Hope. At all events, all the trade of Europe with the western coast of the Pacific and the Polynesian islands, and all her whale fishing, and *all* the trade of the United States with the Pacific, without the exception of a single vessel, would pass

through it; the amount of saving one which, in time, interest of money, navigating expenses and insurance, by avoiding the stormy passage around Cape Horn, I have no data for calculating.

On broad grounds, this work has been well characterized as "the mightiest event in favor of the peaceful intercourse of nations which the physical circumstances of the globe present to the enterprise of man." It will compose the distracted country of Central America; turn the sword, which is now drenching it with blood, into a pruning hook; remove the prejudices of the inhabitants by bringing them into close connexion with people of every nation; furnish them with a motive and a reward for industry, and inspire them with a taste for making money, which, after all, opprobrious as it is sometimes considered, does more to civilize and keep the world at peace than any other influence whatever. A great city will grow up in the heart of the country, with streams issuing from it, fertilizing as they roll into the interior; her magnificent mountains and valleys, now weeping in desolation and waste, will smile and be glad. The commerce of the world will be changed, the barren region of Terre del Fuego be forgotten, Patagonia become a land of fable, and Cape Horn live only in the recollection of sailors and insurers. Steamboats will go smoking along the rich coasts of Chili, Peru, Equador, Grenada, Guatemala, California, our own Oregon territory, and the Russian possessions on the borders of Behring's straits. New markets will be opened for products of agriculture and manufactures, and the intercourse and communion of numerous and immense bodies of the human race will assimilate and improve the character of nations. The whole world is interested in this work. I would not speak of it with sectional or even national feeling; but if Europe is indifferent, it would be glory surpassing the conquest of kingdoms to make this greatest enterprise ever attempted by human force entirely our own work; nay, more, to make it, as it was once attempted, entirely the work of our city; for it is to furnish a new field for the action of that tremendous power which, first brought into being under our own eyes, is now changing the face of the whole moral, social, and political world. Is it too much to hope, in honor of services poorly paid but never to be forgotten, a steamboat bearing the glorious name of Fulton, may start from the spot where he made his first experiment, and open the great "highway of nations" to the Pacific ocean?

Thursday, February 27.—At three o'clock, in the morning, we left the yard of the licenciado; the inhabitants of the town were still sleeping. At daylight we passed a village, where, before the door of one of the houses, a traveller was making preparations to set out on a journey. We accosted him, and he said that he would overtake us on the road. At eight o'clock we reached a house, where we stopped to breakfast.

The hospitality of Central America is in the country, and in the villages; here I never knew it to fail. The traveller may stop where he pleases, and have house, fire and water free, paying only for the articles which he consumes. We had milk in abundance, and the charge

was six cents. Before we resumed our journey, the traveller whom we had passed at the last village arrived, and, after he had taken chocolate, we all started together. He was a merchant, on his way to Leon, accoutred in the style of the country, with pistols, sword, spatterdashes, and spurs; and, as he was then suffering from fever and ague, wore a heavy woollen poncha, a striped cotton pocket handkerchief around his head, and over it two straw hats, one inside of the other. A young man, mounted, and armed with a gun, was driving a cargo mule, and three mozos, with machetes, followed on foot.

The whole of this region along the coast of the Pacific is called the Tierra Caliente. At half-past two, after a desperately hot and dusty ride, without any water, we reached a hacienda, the name of which I have lost; it was built of poles, and plastered with mud; the major-domo was a white man, in bad health, but very obliging, who lived by selling occasionally a fowl or a few eggs to a traveller, and corn and water for mules. There were no more of those beautiful streams which had given such a charm to my journey in Costa Rica; the earth was parched—water was a luxury sold for money. There was a well on the hacienda, and I paid two cents a-piece for our mules to drink. There was a bedstead in the hut; at four o'clock I lay down for a few moments' rest, and did not wake till five the next morning. On a line with the head of my bed was a long log, squared and hollowed out, with a broad lid on the top, and secured by a lock and key, containing the corn and household valuables, and on the top of it were sleeping a woman, rather yellow, and a little girl. I took chocolate, and in a few minutes was in the saddle. Very soon we came in sight of the highlands of Buombacho, a high, dark range of mountains, behind which stood Grenada, which in half an hour we entered. Built by those hardy adventurers who conquered America, even yet it is a monument worthy of their fame; the houses are of stone, large and spacious, with balconies to the windows of turned wood, and projecting roofs, with pendent ornaments of wood, curiously carved.

I rode to the house of Don Frederico Derbyshire, to whom I had a letter from friends in New York. He had gone to the United States; but his clerk, a young Englishman, offered me the house, gave me a room, and in a few moments my travelling clothes were off and I was in the street. My first visit was to Mr. Bailey, who lived nearly opposite with an English lady, whose husband had died two years before, and who, besides carrying on his business, received into her house the few Englishmen or foreigners whom chance brought to that place. My appearance at Grenada created surprise, and I was congratulated upon my liberation or escape from prison. News had reached there that I had been arrested, (I do not know for what,) and was in prison in San Salvador; and, as all news had a party bias, it was told as another of the outrages of General Morazan.

The house of this lady was a comfort to a battered traveller. I could have remained there a month; but, unfortunately, I heard news which did not allow me much time for rest. The black clouds

which hung over the political horizon had burst, and civil war had broken out anew. The troops of Nicaragua, fourteen hundred strong, had marched into Honduras, and, uniting with those of the latter State, had routed, with great slaughter, the troops of Morazan, stationed at Taguzegalpa. The latter consisted of but four hundred and fifty men, under the command of General Cabanes, and the records of civil wars among Christian people nowhere present a bloodier page. No quarter was given or asked. After the battle, fourteen officers were shot in cold blood, and not a single prisoner lived as a monument of mercy. Cabanes, fighting desperately, escaped. Colonel Galindo, to whom I have before referred as having visited the ruins of Copan, known both in this country and in Europe for his investigation of the antiquities of that country, and to whom I had a letter of introduction from Mr. Forsyth, was murdered. After the battle, in attempting to escape, with two dragoons and a servant boy, he passed through an Indian village, was recognised, and they were all murdered with machetes. A disgraceful quarrel ensued between Quejanos and Ferrera, the leaders of the Nicaragua and Honduras troops, for the paltry spoils; and the former got Ferrera into his power, and for twenty-four hours had him under sentence to be shot. Afterward, the matter was accommodated, and the Nicaraguans returned to Leon in triumph, with three hundred and fifty muskets, several stands of colors, and as a proof of the way in which they had done their work, without a single prisoner.

At San Salvador there had been an ominous movement. General Morazan had resigned his office of chief of the State, retaining command of the army, and sent his wife and family to Chili. The crisis was at hand; the notes of war sounded fearfully, and it was all important for the prosecution of my ultimate designs, and for my personal safety, to reach Guatemala while yet the road was open.

I would have gone on immediately, but felt that I might exert myself too far and break down at an awkward place. In the afternoon, in company with Mr. Bailey and Mr. Wood, I walked down to the lake. At the foot of the street by which we entered, built out into the lake, was an old fort, dismantled and overgrown with bushes and trees, a relic of the daring Spaniards who first drove the Indians from the lake; probably the very fortress that Cordova built, and in its ruins beautifully picturesque. Under the walls, and within the shade of the fort and trees growing near it, the Indian women of Grenada were washing; garments of every color were hanging on the bushes to dry and waving in the wind; women were wading out with their water-jars, passing beyond the breakers to obtain it clear of sand; men were swimming, and servants were bringing horses and mules to drink, all together presenting a beautifully animated picture. There were no boats on the water, but about half a dozen piraguas, the largest of which was forty feet long, and drew three feet of water, were lying on the shore.

Extract from the American Quarterly Review.

We will now, in pursuance of the plan chalked out, proceed to the examination of the two subjects before alluded to, viz: first, the problem of the communication of the Atlantic and Pacific oceans; and, secondly, the monuments of antiquity which have been found scattered over Guatemala.

It was in the year 1513, that Vasco Nuñez de Balboa discovered the width of Panama to be so inconsiderable; since which memorable epoch in the history of geographical discovery, we are told, the project of a canal has occupied every mind. The vulgar objection raised against it on account of the possibility of one sea having a greater elevation than the other, Humboldt shows to have been an idle observation, which has been common in every age. The waters in the Gulf of Panama are said to be higher than those in the Atlantic ocean, while the surface of the Gulf of Mexico is considered more elevated than that of the Pacific. Anciently the Gulf of Corinth, near Lechæum, was believed to be above the level of the sea of Cenchreæ; it was also conceived that the Mediterranean, in consequence of a similar inequality, had burst its way through the pillars of Hercules, now called the Straits of Gibraltar; and Strabo predicted that the sea would one day open the isthmus of Suez. In regard to the latter, it has been mooted whether Africa was not formerly an island, it being said that various princes of antiquity employed their treasures in cutting a communication between the Mediterranean and the Red sea; but Sir Thomas Browne ranks this among the vulgar errors of history, and rather thinks their object was mistaken, which was in reality to open a passage from the Nile to the Red sea, and of which indirect communication there are vestiges of canals to this day.* It appears that while the French army were in Egypt, the subject was largely discussed as to the restoration of these canals; but it was finally determined that as the navigation would on the one side depend on the rising of the Nile, and on the other, on the monsoons which prevail in the Arabian Gulf; and as these two conditions do not coincide to such a degree as to allow uninterrupted navigation, it is very probable that these canals, though highly useful and necessary for the commercial prosperity of Egypt, would produce no great revolution in the East India trade.† The isthmus of Suez is now about seventy miles wide; Malte Brun makes the surface of the Mediterranean about thirty feet lower than the water in the Gulf of Suez; and Humboldt says the French engineers found it only six toises, or about twenty feet.‡

But it is asked what are the vast advantages which the project

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* Pseudodoxia Epidemica, page 269.
† Malte Brun, v. iii., p. 443.
‡ Polit. Es. on N. S., v. i., p. 32.

promises? To this it has been answered, that the advantages of the junction are as various as the numerous branches of trade which would be either facilitated or called into existence. The intercourse of Europe and America would be immensely augmented; the South sea trade, the whale fisheries, the facilities for working the mines in the central provinces, in Chili, and Peru, would be increased; and the voyage to the East Indies, China, and the islands in those remote seas, would be shortened in a remarkable degree, besides saving so much time, and avoiding so many risks incurred by the circumnavigation of the two great southern capes. *The whole of these trades, it is observed, would be carried on through the new channel.**

This subject attracted the attention of Humboldt, whose genius pervaded all New Spain, (under which denomination was formerly included Guatemala;) few subjects connected with which interesting country escaped his sagacity. It should be borne in mind, however, that this eminent traveller visited New Spain under restrictions of peculiar kind. Spain waived her jealousy in his favor, and granted him a permission conceded to none else. Of this permission, the baron was a man of too much honor to take an improper advantage. Accordingly, the confidence which, under other circumstances, would naturally be yielded to him, must, on particular points, be given with some grains of allowance, since a principle of delicacy forbade his speaking on certain matters, while on other occasions it prompted him to promulge no other opinions than

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* "We are tempted to dwell," says the Edinburg Review, "for a moment, upon the prospects which the accomplishment of this splendid, but not difficult enterprise, opens to our nation. It is not merely the immense commerce of the western shores of America, extending almost from pole to pole, that is brought, as it were, to our door; it is not the intrinsically important, though comparatively moderate branch of our commerce, that of the South sea whalers, that will alone undergo a complete revolution, by saving the tedious and dangerous voyage round Cape Horn; the whole of these immense interests which we hold deposited in the regions of Asia, become augmented in value, to a degree which at present it is not easy to conceive, by obtaining direct access to them across the Pacific ocean. It is the same thing as if by some great revolution of the globe, our eastern possessions were brought nearer to us. The voyage across the Pacific, the winds both for the eastern and western passage being fair and constant, is so expeditious and steady, that the arrival of the ships may be calculated almost with the accuracy of a mail-coach. Immense would be the traffic which would immediately begin to cover that ocean, by denomination Pacific. All the riches of India and China would move towards America. The riches of Europe and America would move towards Asia. Vast depots would be formed at the great commercial towns, which would immediately arise at the two extremities of the central canal; the goods would be in a course of perpetual passage from one depot to the other; and would be received by the ships as they arrived, which were prepared to convey them to their ultimate destination.

Is it too much to hope, that China and Japan themselves, brought so much nearer the influence of European civilization, would not be able to resist the salutary impression, but would soon receive important changes in ideas, arts, manners, and institutions? The hope rests, at least, on such strong foundations, that it seems to rise even to certainty; and, then, what glorious results might be expected from the whole of Asia, that vast proportion of the earth, which, even in its most favored parts, has been in all ages condemned to semi-barbarism and the miseries of despotic power! One thing, at least, is certain, that South America, which stands so much in need of the industrious inhabitants, would receive myriads of laborious Chinese, who already swarm in all parts of the eastern Archipelago in quest of employment and of food. This, to her, would be an acquisition of incredible importance; and the connexion thus formed between the two countries, would still further tend to accelerate the acquisition of enlightened views and civilized manners in China herself.—Vol. xiii., p. 285, January, 1809.

those which harmonized with the policy of the Spanish government.

Humboldt presents nine different points, which, at various times, have fixed his attention, and which offer greater or less probability either of canal or interior river communication. These we will briefly enumerate:

1s. In 54° 37' of north latitude, the sources of the river of Peace or Ounigigah approach within seven leagues of the Tacoutche Tesse, supposed to be the same as the Columbia river. The first disembogues into the Northern ocean through the Slave lake and Mackenzie river; the second, or Columbia, enters the Pacific to the south of Nootka Sound.

2d. In latitude 40° north, the Rio del Norte or Rio Bravo, which flows into the Gulf of Mexico, is only separated from the Colorado by a mountainous tract of from twelve to thirteen leagues in breadth.

3d. In 16° north latitude, the isthmus of Tehuantepec comprises the sources of the Huasacualco, which is discharged into the Gulf of Mexico, and the sources of the Chimalapa, the waters of which last mix with those of the Pacific near the bar of St. Francisco. In the year 1800, a road was completed from the port of Tehuantepec, by means of which the Huasacualco formed in reality a commercial communication between the two oceans.

4th. The great lake of Nicaragua communicates not only with the lake of Leon or Managua, but also on the east with the Atlantic. A canal, he supposes, might be cut either across the isthmus, which separates the lake from the Gulf of Papagayo, or through the lake Leon, across to the river Tosta. Of these, however, we will have occasion to speak more diffusely hereafter.

5th. By the isthmus of Panama, by means of the Chagres, or direct to Porto Bello, or by other routes in this region, which are dircussed at some length in the Political Essay.

6th. Southeast of Panama, on the Pacific, between Cape St. Miguel and Corriente, is the port and bay of Cupica. From Cupica, for several leagues, extends a route quite level and proper for a canal to the river Naipi, flowing into the Atrato, which itself enters the Atlantic. "We might almost say," remarks Humboldt, "that the ground between Cupica and the mouth of the Atrato is the only part of all America where the chain of the Andes is entirely broken."* This appears to be a mistake, since the author notices that the river St. Juan, which falls into the Pacific, and the Atrato into the Caribbean sea, offer by the Raspadura an unbroken navigation from sea to sea; of course the chain of the Andes is broken here.

7th. In the interior of the province of Choco, a small ravine unites the river St. Juan and the small river Quito. This, in conjunction with several others, forms the Atrato, which discharges into the Atlantic, while the St. Juan flows into the South sea. It

* Pol. Es. vol. 1, p. 40.

is a very remarkable fact, and now well known, that a monk of Novita employed his parishioners to dig a small canal in the ravine of Raspadura, by means of which, when the rains were abundant, canoes loaded with cacao *passed from sea to sea!* This communication is said, by Humboldt, to have existed from 1788, entirely unknown in Europe; but the fact is, it was known more than a century, and thus it appears that a canal communication has actually existed here, uniting on the opposite coasts, seventy-five leagues distant.

8th. To the north of Lima, in Peru, is the river Guallaga or Huallaga. The sources of the Huanaco, which runs into the latter, are only about five leagues from the Huaru, which flows into the Pacific. The nature of the ground here renders a canal impracticable; but a road from the capital of Peru to the Huanaco, would facilitate the transport of goods to Europe. By this channel the productions of Peru might be carried to the Grand Para, in Brazil, one of the mouths of the river Amazon, in five weeks, while a voyage round Cape Horn would require, perhaps, as many months.

9th. The last project was based upon the supposition that the Bay of St. George, on the east coast of Patagonia, penetrated farther into the land than subsequent investigation proved to be correct. Consequently, there is no occasion to dwell upon this section. In a retrospect of these points of communication between the two oceans, by the junction of the neighboring rivers either by canals or carriage roads, Humboldt recommends a survey of the isthmus of Guasacualco, the Lake Nicaragua, the region between Cruces, on the Chagres, and Panama, and between Cupica and the river Naipi, as a means which would enable us to make an election whether this gigantic undertaking should be executed at Mexico or Darien; an undertaking calculated to immortalize the government by whom it may be carried into effect

Of all these schemes, that by the lake of Nicaragua seems to have offered most facilities, and to have occupied the greatest share of recent attention. Accordingly, sundry plans were set on foot by English capitalists, and an association formed for cutting a canal between Lake Leon and the river Tosta. From the prospectus of the committee, it appears that this line was long known and deemed practicable, but was concealed by the policy of Spain, and that the drawings relating to it were obtained accidentally by a gentleman residing at the court of Madrid. These documents state that in the province of Nicaragua, in 10° 10′ north latitude, the river San Juan falls into the Atlantic ocean; that it is navigable from the sea to the lake for ships of two hundred or three hundred tons burden; but that it may be made navigable for the largest vessels, the passage being at present obstructed by ships sunk by the Spaniards for the purpose of preventing the intrusion of foreign navigators.

Another line of communication specified by the document, is presented from the Lake Leon, on the southern shores of which is situated the town of Tipitapa. From hence, a canal might be cut into another river of the name of San Juan, which empties into the Pacific by the port of that name, in the Gulf of Papagayo. The

distance from the Lake Leon to where the cut would strike the San Juan, is twelve miles; the whole distance to the Pacific, about thirty.

But the river San Juan has been represented as innavigable for large ships, and maps and charts of South America have so described it. Nothing is more fallacious; for it is a well known fact that the Spaniards prohibited the navigation of this river under penalty of death; that they sank hulks, and fortified its entrance. It is also well known, adds the document, that Spain has often wilfully misdescribed the nature of some of her South American colonies to prevent the intrusion of other nations; and only since the establishment of the independence of those countries could foreigners land on their shores. From the estimates made by the company, it was calculated that the profits to accrue from the tolls of vessels passing and repassing, would be sufficient, after defraying all expenses, to replace, in the course of ten years, the original capital, besides giving in the interim a considerable dividend.

About this time, Mr. Thompson informs us, there were two companies formed in England for the general purpose of effecting, by steam navigation or otherwise, a water communication between the oceans. Proposals were made, bearing date the 8th September, 1824, to accomplish this at the point in question, by some British merchants, without any expense to the government, provided the latter would give the projectors every necessary assistance. On the 2d of February, 1825, other propositions were made by some merchants of the United States, and signed by Colonel Charles Bourke and Mr. Mathew Llanos. The terms proposed to give to the government, it is said, twenty per cent. on the annual product of the tolls to be paid by vessels passing through the canal, and after the expiration of a specific term, the canal was to become the exclusive property of the government. The conditions required were: 1st, an exclusive privilege for the purpose; 2d, an exclusive privilege for navigation by steamboats on the rivers, and on the waters of the three provinces, as far as the lake where the said canal is to be opened; 3d, permission to cut wood in the said province; 4th, exemption from duty on the introduction of goods, on account of the company, until the canal be completed.

"Of the above propositions," says Mr. T., "on the part of Messrs. Barclay & Co., and of the merchants of the United States, no specific notice appears to have been taken; but, on the 16th of June, 1825, the Congress passed a decree, which obtained the approbation of the Senate on the 11th July, and was confirmed by the executive on the 12th of that month, which promises the sanction and assistance of the State to any parties who would undertake the project, and to recognize, as a public debt, the money expended in the execution of it; the passage dues to be applied to paying off the capital sunk in its opening, and to satisfy the interest thereon, deducting, first, the expenses which the repairs of the said canal shall require, the costs of collecting the dues, and of a garrison for its defence; the navigation to be free to all nations, friendly or neutral, without any privilege or exclusion.

"On the 1st August, 1825, the executive extended the time for receiving proposals to six months longer. The consequence has been that the Dutch, as I have before stated, stepped in and possessed themselves of the undertaking. When I left the republic, I felt assured that it would have been carried into execution by the British, and I cannot suppress my mortification that foreigners should have the exclusive honor, to say nothing of the advantage, of so great an enterprise; for it is one which can be but *once* effected amidst the noble achievements of eventful time."

Mr. Thompson has given us a valuable chart, showing the divisions of the five States of Central America, accompanied by an ideal sketch, pointing out the facility with which a communication may be made between the oceans, by the port and river of San Juan in the Pacific, the navigation of the river San Juan on the opposite side being assumed as perfectly feasible. He also obtained a "*table of levels*," taken between the western side of the lake and the South sea, from which it appears that the former is forty-four yards, Spanish, and a fraction, above the level of the other. It is also remarked that, although, in all the maps extant, the intervening tract is represented as mountainous, the greatest actual height of the land is only 19 feet 1 inch. The distance between the lake and the sea, at the proposed communication, is only 4 leagues 4,687 yards, of 7,000 yards, Spanish, to the league.*

Here let us pause a moment. We stated above that Mr. Thompson's mysterious observation, upon Don Mateo's siesta, was the most formidable and obscure passage in his book, but we are now compelled to give up that first impression in favor of the pre-eminent obscurity of the "table of levels." We are not familiar with the Shibboleth of topography, but we must be permitted to express a shrewd doubt whether any engineer could make Mr. Thompson's "table of levels" quadrate with common sense. We would not willingly tire the reader with "sums in Gibraltar," but the arithmetical confusion is so inextricable, that we believe the author understood the matter no better than we do ourselves. If the levels commence at the South sea, as is expressed, and if the caption of descents and ascents be correct, then, instead of the lake being 133 feet 11 inches and 7 lines† above the surface or level of the South sea, it must needs be that number of feet, inches, and lines, below it; but the fact is, the present results could only have been obtained by inverting the caption, or substituting ascents and descents for descents and ascents. Again, if the levels are really begun at the South sea, and the caption be correct, the land at level 219, which is set down at 19 feet 1 inch above the level of the lake, is 365 feet 1 inch and 2 lines below that point, or 233 feet 5 inches and 8 lines below the South sea, which is hardly probable; but if, on the other hand, the descents and ascents be in-

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* Appendix to Hist. and Stat. Sketch, p. 520.

† The difference, by the way, of this sum of descents and ascents should be 131 feet 7 inches and 6 lines, instead of 133 feet 11 inches and 7 lines. But Heaven defend us from such a labarynth of blunders!

verted, with the same condition of commencing at the South sea, the level 219 is 101 feet 10 inches and 2 lines above the lake, or 233 feet 5 inches and 8 lines above the South sea.

But to return. Looking at the isthmus, which is the true point of separation between North and South America, and destined at some day not remote to become the medium of as great a revolution in the channels of commerce—by means of a canal between the two great oceans—as that produced by the doubling of the African capes, it produces surprise that there is no accurate, or even plausible, account of its topography. The Spanish policy was, no doubt, successful in this; but the accounts published since the revolution have not improved upon what was generally known before; and, in fact, the earliest public accounts we have, those of Dampier and Wafer, in 1631, are more satisfactory than any to be found in more than twenty professed expositions. It may subserve literary inquiry, since no complete exhibition has yet been published, to know some historical facts in relation to it.

A survey was made by authorized Spanish officers, but never published, in 1528.

Dampier and Lionel Wafer describe the bay of Panama and its topography in 1631.

An account published by Sharp and Funnell in 1703.

An account by Don Ulloa, very defective, in 1726.

A work containing thirty-two maps and a survey, captured from the Spaniards, and published by Jeffries in London in 1762.

An account by Bryan Edwards, in his History of the West Indies, 1799.

A survey was made, with a view to internal navigation, by the Engineer Manuel Gallisto, under the intendency of Don Galvez, 1781.

Humboldt's first account, in his History of New Spain, 1803.

Humboldt's second account, in his Personal Narrative, 1820.

A Spanish hydrographical chart, prepared in Spain, but suppressed, 1805.

Walton's account, very defective, 1807.

Interesting particulars in the Endinburgh Review, from which we made a large extract in a note above, for January, (supra, 226,) 1809.

W. D. Robinson's account, compiled, 1820.

Captain Hall's partial account, 1822.

A proposal made by an American to the Columbian government with a plan, but not published, 1822.

A proposal made by Mr. Ripley, an American, with a plan for a canal by Cupica, 1823.

Captain Cockrane's account in his travels, very delusive, 1823.

A project of Hislop & Co., a mercantile house of Jamaica, who sent surveyors, but they were expelled, 1823.

Purdy's imperfect account, 1824.

Bourke and Llanos, of which we spoke above, 1825.

Pitman's compilation of various accounts and projects, very defective and contradictory, 1825.

A report made to the Royal Society of London, (not published,) 1827.

These embrace, we believe, nearly all the published accounts in relation to the designs of a canal; but many points of intersection are said to exist, by which a canal would be practicable at half the expense, and without a tenth of the difficulties by which the canal between the two seas was constructed in Scotland.

HOUSE OF REPRESENTATIVES.—March 2, 1839.

Mr. MERCER, from the Committee on Roads and Canals, submitted the following report:

The Committee on Roads and Canals, to whom was referred the memorial of Aaron Clark, mayor of the city of New York, Herman Le Roy, William Radcliff, and other merchants and inhabitants of that city, and of Matthew Carey, of the city of Philadelphia, and other citizens thereof, praying the aid of the government of the United States in procuring the construction of a ship channel, or navigable canal, across the isthmus between North and South America, have had that subject under consideration, and report:

That the object of the memorialists has, from a remote period, attracted the attention of the civilized world.

It is impossible to survey the relative position of the old and new continents, and the impediments thence resulting to the intercourse of the various countries upon the shores of the Pacific and its numerous islands, with the commercial nations of Europe and the States bordering on the Atlantic, without being struck by the number and magnitude of the interests, commercial, social, and political, involved in the construction and untrammelled use of a ship channel across the narrow isthmus, stretching over seven degrees of latitude, from the Balize, or Gulf of Honduras, to the mouth of the river Chagres and the bay of Panama.

The United States of America, especially, whose territory extends from the Atlantic to the Pacific, cannot but regard with solicitude any enterpise which, if practicable, will so greatly approximate their eastern and western frontiers, by substituting a voyage through the isthmus of Panama, for the necessity of doubling the southern cape of either continent. If science, christianity, and civilization be allowed to mingle their voices in behalf of an enterprise so beneficent, it is not possible to contemplate on the surface of our globe one which has greater claims to the favorable regard of the world.

Accordingly, it will be seen that, in addition to the suggestions of numerous voyagists and travellers, explorations and experimental surveys have been made across the isthmus of Panama, with a view to ascertain the practicability of effecting such a communication. And amidst the bloody commotions of a political revolution, unrivalled for the extent of the dominion which it suddenly subverted, and of the countries whose independence it established, legislation has not been wanting in its efforts to deduce from those experiments some practicable benefit to mankind.

The great extent of the territory comprehended at present under

the general denomination of the isthmus of Panama, has presented to the imagination so many routes across it for canals, and, of late, for railroads, as to have hitherto prevented that concentrated action essential to the accomplishment of any one.

The States of Spanish America whose jurisdiction embraces that portion of the continent exhausted by their effort to overthrow their former government, and, still more, by their intestine commotions, could not be expected to undertake, without the assistance of foreign capital, a work of such vast magnitude. They have, nevertheless, demonstrated their sense of its importance to their own prosperity, as well as to that of the commercial world; and, what redounds still more to their honor, they have expressed their readiness to receive the aid of other nations towards this enterprise, upon conditions which manifest a disposition to waive, for the welfare of mankind, every narrow and unsocial suggestion of local interest.

It is obvious that, if the contemplated communication from sea to sea by a ship canal be practicable, the nation which has the right to appropriate its exclusive use to itself, might lawfully control the richest commerce of the world, or prescribe to all other States the terms upon which they may be admitted to share its enjoyment. The policy is not less apparent which should prompt the United States to co operate in this enterprise, liberally and efficiently, before other dispositions may be awakened in the particular State within whose territory it may be seated; or other nations shall seek, by negotiation, to engross a commerce which is now, and should ever continue, open to all.

The public mind has so far settled the relative cost and advantages of the rival communications by railroads and canals, regarded as mere channels of trade, that there will exist no hesitation, it is presumed, in preferring a water to a land transit across the isthmus.

If other considerations did not prompt this decision, it should suffice, for its confirmation, to contrast the continuous voyage of the same vessel across the two oceans, divided by the isthmus, with the transhipment of a heavy cargo between vessels of equal burden, and the intervening expense of land transportation, double port duties and commissions, added to the damage of shifting and exposing very valuable commodities to waste and depredation.

Most of the objections to the double voyage apply with nearly equal force to any canal communication of a capacity unsuited to that of the vessels now engaged in the India and China trade. The reduction of the present circuitous route around the southern extremity of either continent, by a distance of from nine to twelve thousand miles, would admit, it is true, without augmented cost, of the use in this trade of ships of diminished burden. But it would be eminently beneficial to a commerce in which the returns of profit must continue to be remote, that the vessels engaged in it would retain their present tonnage; and for such vessels a canal would be required exceeding in dimensions any now known to exist.

The Caledonian canal of Scotland, one of the only two canals in Great Britain constructed by her government, and that of Holland, connecting Amsterdam with the German ocean, at the Helder, are capacious enough to admit the passage of vessels drawing less than twenty feet water.

The former was effected by excavations 23 miles in extent, and a lockage of 190 feet, connecting a succession of fresh water lakes, the beds and outlets of which were deepened to correspond with the intervening canals; the latter, of 50½ miles in extent, with a single guard-lock at each entrance, draws its supply of water from the ocean.

For canals of such large dimensions, (and these are not deep enough for a heavily freighted Indiaman with a war complement of guns and men,) an adequate supply of water, at a very high level above the sea, will rarely be found anywhere.

The narrow breadth of the isthmus, and, consequently, of the surface of land drained by its rivers, added to the long continued prevalence of dry weather at certain seasons, in all tropical climates, discourage the hope that such a supply can be obtained near the summits of its mountainous and rugged surface. The expediency has indeed been suggested, but on very incompetent data, to extend an open cut from sea to sea, of dimensions suited to the largest ships; and attempts have been made to trace on the maps a route for this gigantic enterprise. As yet, none such has been discovered in the isthmus, and it is confidently believed that none will ever be found.

An objection has been intimated to its use, if practicable, on account of the supposed difference in the natural elevations of the seas to be united by it. Captain Cook believed the surface of the Atlantic to be near twenty feet higher than that of the Pacific; and the tides of this ocean are known greatly to exceed those of the Atlantic on the opposite shores of the American isthmus; hence has arisen the apprehension that the influx of water from the higher to the lower surface, through an open cut, would change the relative elevation of those oceans so as to flood the shores of one, and lay dry those of the other.

If there be a real difference in the levels of those seas, as there has been ascertained to be in their periodical tides, such apprehension must be allayed on considering the vast extent of the effect to be produced, and the incompetency of the cause assigned for it —the wide extent of either ocean, and the great length and comparatively narrow dimensions of any open cut designed to connect them for the purposes of navigation.

But it is hazarding nothing, in the present state of our knowledge of the isthmus, to affirm that such an open cut, through any one of its narrowest and lowest passes, would constitute a labor surpassing very far in magnitude, not only any single one of the greatest works of ancient or modern times, but all of them collectively.

If abandoned, in despair of its accomplishment, then an adequate supply of water must be sought at a higher elevation than the natural surface of either of the oceans to be united.

Accordingly, the appendix discloses a series of levels, repeated at intervals not exceeding a hundred yards apart, between the southern shore of lake Nicaragua and the Pacific, comprising a distance of very little more than seventeen English miles.

From the tables which supply the details of those levels, the author to whose work they are annexed infers the elevation of the surface of Lake Nicaragua above the Pacific ocean to be 133 feet 11¼ inches; and the greatest height of any part of the intervening land, above the lake, to be but 19 feet 1 inch.

In this assumption he mistakes the true import of the tables, and substitutes the comparative elevations of two contiguous stations, on the long series of levels, for the highest rise above the lake.

The subjoined delineation of the cross section of the country traversed in the survey to which the tables refer, prepared in conformity with their details by the topographical bureau of the War Department, at the request of the committee, presents the outline of the surface along this selected route for a canal.

For 9 miles and 700 yards (English) from the Pacific, the earth is not found to rise above the level of the lake; the ascent is gradual throughout that distance, and as favorable for a canal as could be desired. The succeeding mile rises above the lake, at one place, 40 feet, (Spanish,) but the average height does not, in this distance, exceed 25 feet.

The difficulties attending the construction of a continuous canal on this route are confined to the seven or eight miles next to the lake, for about six miles of which the earth rises to an elevation above its surface exceeding 60 feet; for two miles of the six, it averages 135 feet; and for a third of a mile, 150 feet; but it never exceeds that height.

If the level of the lake be assumed for the summit of a canal, there must be added to the elevation above mentioned an excavation of the depth of the channel for navigation, which should not be less than the draught of a large frigate, or nearly twenty-six feet.

Various representations are furnished, by different authors and travellers, of the navigation of Lake Nicaragua, and of its outlet to the Atlantic, the river San Juan. That to be found in the appendix to this report is extracted from a work which carries an official stamp upon its face, and was, by permission, dedicated to the monarch in whose service the author was employed, shortly after the revolution which liberated the province of Guatemala from the dominion of Spain.

Much remains to be discovered, provided the surface of the country between Lake Nicaragua, or the more northern lake of Leon, as has been suggested, and the shore of the Pacific, admits of the extension of a ship channel between them. Before such an enterprise should be commenced, it should be previously ascertained that an adequate supply of water can be furnished by the lake at all seasons, or at least for the greater part of the year; that suitable harbors can be provided at each extremity of the line

of navigation; and that it affords the best route for a ship channel across the American isthmus.

Looking much farther to the south, Navy bay, on the Atlantic, in the vicinity, and but a few miles to the east of the mouth of the river Chagres; the bays of Panama and Chorrera, on the Pacific; that river itself, and its chief tributary, the Trinidad, descending from the north, have been proposed as the entrances and the route of a ship channel between those oceans.

The mouth of the Chagres is reputed too unhealthy for the eastern debouche of a line of continuous navigation of such importance; but Navy bay affords a deep, secure, and salubrious harbor, at all seasons; and is approached so near by the river, in its descent to the Atlantic, as to present every requisite facility for its connexion with the Chagres by a ship canal not exceeding two miles in length.

The river Chagres is obstructed in its ascent by rapids, and decreases in its volume till, at Cruces, it ceases to be navigable. From thence, a portage of about fifteen miles leads over an intervening ridge to the ancient town of Panama, which gives its name to the entire isthmus.

Not far above its mouth this river receives the Trinidad, of which less is known—too little to determine whether it be practicable to render its valley and its sources subservient to the interesting purpose of this inquiry. But the bay of Chorrera, on the Pacific, reputed to afford a better harbor than that of Panama, is represented as approaching very near the head waters of this branch of the Chagres; if, indeed, the Trinidad be not entitled to be regarded as the principal stream, and the Chagres as its tributary.

The present road from Cruces, over land, to Panama is mountainous for a distance of six miles; and, as the cordillera of the Andes declines in height as it runs northwardly through the isthmus until it subsides into the comparatively level country near the lakes Nicaragua and Leon, the country is, in all probability, more elevated here than at the sources of the Trinidad.

The fact that the valley of the Chagres has been contemplated as the route of a railroad, designed to supersede a water communication between the Atlantic and Pacific, and that a charter was obtained from the former government of Central America for the construction of such a road, by an agent of the United States, deputed by the President, in pursuance of a resolution of the Senate, to explore the route of a ship canal through the isthmus, diminishes the hope that a continuous water communication could be opened on this route. The Trinidad, however, remains to be explored; and, rising where the isthmus expands in breadth, the route for a ship canal between Chorrera and Navy bay cannot be pronounced impracticable without further examination.

While a tropical climate, dividing the year into but two seasons, denominated the wet and dry, exposes any line of artificial navigation which may be conducted across the American isthmus to interruptions from drought, it is proper to notice that, during its

periodical rains, more than twice the quantity of water descends upon the earth than annually falls upon a like extent of surface in any part of Europe or of the United States. A celebrated traveller, Baron Humboldt, represents the quantity of rain annually falling in America, as far north as La Vera Cruz, to vary from 89 to 96 inches; while the highest estimated average for the temperate climates of Europe or America does not much exceed 40 inches, and that of the year often falls short of that quantity.

The practicability of filling, and retaining full, for a great part of the year, reservoirs of the largest dimensions, anywhere within the isthmus, may be regarded as demonstrable; but, as yet, sufficient data are not supplied for the measurement of the loss of water to be sustained in the dry season of a tropical climate from evaporation alone; and, although a redundancy of water would be supplied in the wet season, the capacity of the reservoir limits the measure of all that could be preserved for the purposes of navigation.

The House need not be informed that artificial reservoirs of greater or less dimensions, collecting the surplus water in wet seasons, to be used in those of protracted drought, have been often successfully applied to the necessities of navigation; and experience has not only established their utility, but prescribed the extent of the reliance to be had upon them for adequate supplies of water in particular climates, and for canals of given dimensions and use. The great canal of Languedoc, regarded by the contemporaries of Louis XIV. as one of the greatest achievements of his brilliant reign, several canals of Great Britain, and those of recent construction in the States of Ohio and Pennsylvania, afford illustrations of the successful application of such reservoirs to the supply of water for artificial navigation.

England and the United States, as well as France, furnish examples of the supply of canals with water, by more costly agents; as well as of its elevation to great heights above its natural level, for other purposes.

The water-works of Marlé, designed to embellish with canals and fountains the grounds in front of the royal palace of Versailles, employ the current of the Seine to elevate its water to the level of the aqueduct, which conveys it over a distance of several miles.

Those of Philadelphia—the pride of that beautiful city—elevate the water of the Schuylkill, by more simple and efficient machinery, to a considerable height, for a more useful purpose—to supply two hundred thousand people with the means of health and comfort. The Union canal of Pennsylvania, which connects the navigation of that river with the State canal of the Susquehanna, relied, for some years, and may still depend in some measure, on a supply of its summit level upon a like recourse, commanded at an enhanced cost.

A mechanical agent has, of late years, been developed in the application of steam as a propelling power; to the improvement of which, experience teaches that no limitation can be prescribed;

and it should not be deemed extravagant if the anticipation be indulged of its future adaptation, where fuel is both inexhaustible and cheap, to the elevation of an adequate quantity of water for the supply of the summit levels of the largest canals.

The committee forbear further to enlarge on the various routes by which it has been, at any time, proposed to connect the waters of the Atlantic and Pacific oceans, through the narrow isthmus which divides them. Of these, the celebrated traveller whose name has already been mentioned enumerates as many as seven.

An allusion to some of them, not hitherto noticed in this report, will be seen in the appendix.

The committee have dwelt more particularly on the two routes of which they have treated in detail, because the late agent of the United States deputed to examine them was especially instructed to inquire into their feasibility; and they have, separately, occasioned the only acts of legislation passed by the governments immediately interested in their improvement.

One of them, morever, obtained the favorable regard of a monarch whose subjects have ever been sedulously watchful of every source of commercial aggrandizement, and who manifested his zeal to promote their views by adventuring a large capital, as an individual subscriber, to the private stock of an incorporated company.

The hostilities which suddenly broke out a few years ago between the Netherlands and Belgium arrested the organization of this company, and their charter has since expired.

In conclusion, the committee are very far from deciding that an enterprise of such incalculable importance as a continuous navigation, by vessels of heavy tonnage, between the Atlantic and Pacific, in the nearest direction from the ports of the United States to the Indian ocean, should be abandoned as impracticable, because a channel for such navigation has not yet been definitively traced across the isthmus between North and South America, nor the cost of its construction accurately determined.

Sensible not only of the benefit which would accrue to mankind, and to the United States especially, but also of the glory to be acquired by promoting the accomplishment of a work so truly beneficent, the committee recommend to the House of Representatives the adoption of a resolution, which is very nearly a transcript from one passed several years ago by the other branch of the national legislature, and, having received at that time a liberal construction from the executive, led to the acquisition of some of the facts comprised in this report.

The committee owe it to themselves to say that, in the absence of information to enable them to form a conclusive opinion on the subject referred to them by the House, they have approached it with a distrust of their own judgment, but with a confident belief that whatever may be the issue of the inquiry which they propose to renew, it can be successfully prosecuted only in the country upon the topography of which its solution depends.

Resolved, That the President of the United States be requested to consider the expediency of opening or continuing negotiations

with the governments of other nations, and particularly with those, the territorial jurisdiction of which comprehends the isthmus of Panama, and to which the United States have accredited ministers or agents, for the purpose of ascertaining the practicability of effecting a communication between the Atlantic and Pacific oceans, by the construction of a ship canal across the isthmus; and of securing forever, by suitable treaty stipulations, the free and equal right of navigating such canal to all nations, on the payment of reasonable tolls.

APPENDIX.

COPY OF A MEMORIAL PRESENTED TO THE HOUSE OF REPRESENTATIVES IN JANUARY 1838.

To the honorable the Senate and House of Representatives of the United States of America in Congress assembled:

The memorial of the subscribers respectfully sheweth:

That your memorialists, in common with many others, have long contemplated an object of immense national importance, requiring and deserving, in their opinion, the co operation of governments, as well as individuals, for its attainment, which they beg leave with deference to recommend to the serious attention of your honorable bodies; in confidence that it will not be deemed presumptuous to offer their sentiments on such a subject, nor beneath the dignity of the representatives of a free people to regard the opinions and suggestions of their constituents on a matter of such importance to the public good.

The object referred to is that of opening a navigable communication between the Atlantic and Pacific oceans, by means of a ship canal across the isthmus which connects North and South America; to be accomplished through the common means and united exertions of different nations, and appropriated for the use and benefit of the world at large, on reasonable terms.

The immense importance of that object is too obvious and striking to require illustration. Its attainment would unquestionably afford higher benefits to a great portion of the world than any similar improvement ever made, or capable of execution, by the hands of man; because it would evidently, from the physical circumstances of the globe, diminish the distance and facilitate the social and commercial intercourse between larger bodies of the human family, and to a much larger extent, than is practicable by human means in any other part of the world.

The anticipation of its accomplishment has, therefore, been indulged in by mea of reflection ever since the discovery of Ameri-

ca, as a necessary consequence in time of the very form and position of this continent, and the wants of trade and intercourse on its different sides; but, during the long continued sway of Spain over the isthmus, and of her contracted policy, it could not be achieved, and was necessarily postponed until a more propitious period should arrive.

Such a period has at length manifestly arrived—even long before this—in consequence of the emancipation of the Spanish colonies, including the isthmus; the prevalence of peace and commerce; the accumulation of pecuniary means, and increase of physical strength; and more especially the general spread of intelligence and march of improvement; which circumstances have induced many individuals and some governments (even our own government) to take some leading steps in relation to the subject of late years; but as yet no adequate measures have been adopted or devised to effectuate the great end in view.

In the opinion of your memorialists, the proper accomplishment of that end requires and well deserves the united counsel, contribution and direction of the leading governments of Europe and America; because they are all deeply concerned in its results, which would affect their future peace and harmony as well as their general commerce; and because what is to redound to the benefit of such an immense number, ought not to be left to the unassisted efforts of a few, (especially so difficult and expensive an undertaking as that in contemplation,) but should freely be aided by all, in proportion to the benefits to be received.

It is, therefore, extremely desirable that an extensive and powful combination should be formed, and the most judicious and liberal measures adopted, for the purpose of carrying the plan into effect, and securing its benefits permanently to the world at large.

With that view your memorialists beg leave, with much deference, to recommend that negotiations be opened by our government with the governments of other nations, particularly those of New Grenada and Central America, as controlling each a part of the isthmus through which a *ship canal* is deemed practicable; and those of Great Britain, France, Holland, and Russia, as probably the most disposed to co-operate in promoting the object, for the purpose of entering into a general agreement, by treaty stipulations, to execute the work by united means and exertions for common good, and to secure its use and benefits to the world at large on reasonable terms, as permanently as possible. And they would also recommend, in order to facilitate such negotiations, and induce a more speedy and judicious undertaking of the work, that competent engineers be employed by our government, without delay, to explore and survey the isthmus between North and South America, with the consent of the local authorities thereof, for the purpose of ascertaining with certainty the most eligible route for a *ship canal* across the same, and the probable expense of constructing such a canal; to effect which different purposes, a small appropriation of money would of course be required.

The measures thus with deference recommended by your memo-

nalists, or any other in the opinion of Congress better adapted to the purpose, would probably lead ere long (as is hoped and believed) to an adequate combination of governments and nations for achieving the great end in view, and to a speedy accomplishment of the object; and thus would our government not only have secured to its citizens and their posterity a full participation in its immense benefits, but also to itself the honor and glory and high satisfaction of having originated the plan and taken the lead in regard to its execution.

AARON CLARK,
WM. A. DUER,
HERMAN LEROY,
MATHEW CAREY,
WM. RADCLIFF,
and others.

NEW YORK AND PHILADELPHIA, *January*, 1838.

COMMITTEE ROOM OF COMMITTEE ON ROADS AND CANALS,
March 2, 1838.

SIR: In obedience to the instruction of the Committee on Roads and Canals of the House of Representatives, I have the honor to transmit to you the enclosed resolution, and to subscribe myself,

Very respectfully, your obedient servant,

C. F. MERCER,
Chairman of the Committee on Roads and Canals.

Hon. JOHN FORSYTH,
Secretary of State.

Resolved, That the chairman of the committee be instructed to request the Secretary of State to cause to be translated, and laid before the Committee on Roads and Canals, a copy of the decree of the Congress of Central America, relative to the union of the waters of the Atlantic and Pacific oceans by a canal across the isthmus of Nicaragua.

DEPARMMENT OF STATE,
March 3, 1838.

The Secretary of State presents his compliments to the honorable Mr. Mercer, and informs him that a translation of the decree of the Congress of Central America, called for by the resolution of the Committee on Roads and Canals of the 2d instant, will be transmitted, in the course of two or three days, to the House of Representatives, with the other papers embraced in the resolution of that House of the 17th ultimo.

Hon. C. F. MERCER.

IN THE HOUSE OF REPRESENTATIVES,
February 17, 1838.

The following resolution, submitted by Mr. Mercer, from the Committee on Roads and Canals, was considered and agreed to, viz:—

Resolved, That the President of the United States be requested to lay before this House any information in his possession, which he may deem it proper to communicate, respecting the action of the Executive Department upon the resolution of the Senate of the 3d March, 1835, requesting the President of the United States to consider the expediency of opening negotiations with other nations, and especially with the governments of Central America and New Grenada, with a view to the construction, preservation and use of a ship canal across the isthmus of Darien.

WASHINGTON, *March* 13, 1838.

To the Speaker of the House of Represensatives:

In compliance with a resolution of the House of Representatives of the 17th of February, I transmit a report of the Secretary of State, with the accompanying documents, which contain the information requested.

M. VAN BUREN.

DEPARTMENT OF STATE,
Washington, *March* 12, 1838.

SIR: The Secretary of State, to whom was referred a resolution of the House of Representatives of the 17th ultimo, requesting the President to lay before that House any information in his possession, which he might deem it proper to communicate, respecting the action of the Executive department upon the resolution of the Senate of the 3d of March, 1835, requesting the President of the United States to consider the expediency of opening negotiations with other nations, and especially with the governments of Central America and New Grenada, with a view to the construction, preservation, and use of a ship canal across the isthmus of Darien, has the honor to lay before the President all the information in this department called for by the resolution referred.

Respectfully submitted:

JOHN FORSYTH.

To the PRESIDENT *of the United States.*

Mr. Forsyth to Mr. Biddle.

DEPARTMENT OF STATE,
Washington, May 1, 1835.

SIR: The President has thought proper to employ you for the purpose of making inquiries into the present state of the projects for uniting the Atlantic and Pacific oceans through the isthmus of Darien. You are charged with this duty, with a view to enable him to comply with a resolution of the Senate, which is in the following words:

"IN SENATE OF THE UNITED STATES,
"*March* 3, 1835.

"*Resolved*, That the President of the United States be respectfully requested to consider the expediency of opening negotiations with the governments of other nations, and particularly with the governments of Central America and New Grenada, for the purpose of effectually protecting, by suitable treaty stipulations with them, such individuals or companies as may undertake to open a communication between the Atlantic and Pacific oceans, by the construction of a ship canal across the isthmus which connects North and South America; and of securing forever, by such stipulations, the free and equal right of navigating such canal to all such nations, on the payment of such reasonable tolls as may be established, to compensate the capitalists who may engage in such undertaking and complete the work."

You will therefore proceed by the most direct route to Port St. John, and ascend the river San Juan to the lake Nicaragua, and thence by the contemplated route of communication, by canal or railroad, to the Pacific ocean. You will make such observations and inquiries in your route as will enable you to procure the most copious and accurate information in regard to the practicability of either project, and the time and circumstances under which either will be commenced. After having completed an examination of the route of the canal within the territories of Central America, you will repair to Guatemala, the capital of that republic, and, with the aid of Mr. De Witt, the chargé d'affaires of the United States there, you will procure all such public documents connected with the subject as may be had, and especially copies of all such laws as may have been passed to incorporate companies to carry into effect the undertaking of any convention or conventions that may have been entered into with a foreign power upon the subject; and of any plans, surveys, or estimates in relation to it. You will receive, herewith, a letter to Mr. De Witt, instructing him to assist you in procuring the desired information, and to facilitate your course in any way that may be necessary or proper.

You are also herewith furnished with a circular letter to the same effect to consuls of the United States in Mexico, Central America, and New Grenada.

From Guatemala you will proceed to Panama, where you will

make observations and inquiries relative to the proposed connexion of the two oceans by a railroad from that point; and you will proceed along the proposed direction of the road to the river Chagres, or such other point or points on the Atlantic side of the isthmus as would probably be fixed on for the termination of the road. After having made an examination of this route, as thoroughly as circumstances will permit, you will repair to Bogota, the seat of government of New Grenada, and, with the aid of Mr. McAfee, the chargé d'affaires of the United States there, you will procure such public documents as may be obtainable, in relation to the contemplated road; and, in particular, a copy of any contract that may have been entered into by the government of New Grenada, under the law of that republic relative to the road, passed on the 22d of May, 1834, a translation of which accompanies this letter. You are also herewith furnished with a letter to Mr. McAfee.

You will keep a journal, in which you will note minutely not merely the information you are directed to gather relative to the junction of the two oceans, but, as the published accounts of the regions you will visit are scanty and imperfect, any thing that may tend to illustrate their condition.

Herewith you will also receive a synopsis of the letters upon the subject of your trust, which have been written to and received from the agents of the United States at Guatemala. This will serve as an index as to the general character of the information desired.

Your compensation will be at the rate of six dollars a day, and you will be allowed your necessary travelling expenses, and such as may be incident to the trust committed to you. You will keep an account of your expenses, and will take vouchers, whenever they can be obtained. The sum of fifteen hundred dollars is herewith advanced to you on account.

I have the honor to be, sir, your obedient servant,

JOHN FORSYTH.

CHARLES BIDDLE, Esq.

P. S.—The route marked out above was prescribed to you, because it was believed that, by following it, you might gather the best information in the shortest time; but you are not to consider yourself tied down to it, and may deviate from it whenever it may be necessary to enable you to accomplish that object.

Mr. Forsyth to Mr. De Witt.

DEPARTMENT OF STATE,
Washington, May 1, 1835.

SIR: This will be handed to you by Charles Biddle, esquire, whom the President has thought proper to employ specially for the purpose of gathering information relative to the projects for connecting the Atlantic and Pacific oceans.

Mr. Biddle is directed to procure at Guatemala, with your aid,

such public documents as may have a bearing upon the business, and, in particular, copies of any act of the Congress of Central America that may have been passed to incorporate a company to carry the undertaking into effect; of any treaty upon the subject that may have been concluded with any foreign power; of any plans, estimates, or surveys relative to the enterprise; and of any contract that may have been entered into for its completion.

You are, therefore, instructed to extend to Mr. Biddle your good offices in the matter, and any civilities that may be in your power.

You will also commit to his care despatches containing such information upon the subject as it is presumed you will have obtained.

I am, sir, your obedient servant,

JOHN FORSYTH.

CHARLES G. DE WITT, Esq.

Circular.

DEPARTMENT OF STATE,
Washington, May 1, 1835.

To all consuls of the United States in Mexico, Central America, and New Grenada:

GENTLEMEN: You will receive this from Mr. Charles Biddle, who is a special agent charged by the President to seek information concerning the projected junction of the Atlantic and Pacific oceans, by means of a railroad or canal across the isthmus of Darien.

You will give Mr. Biddle any aid you can towards prosecuting his inquires, and you will extend to him such civilities and attentions as may be in your power.

I am, &c.

JOHN FORSYTH.

Mr. Forsyth to Mr. McAfee.

DEPARTMENT OF STATE,
Washington, May 1, 1835.

SIR: Allow me to introduce to you Mr. Charles Biddle, who is a special agent appointed by the President to make observations and inquiries in respect to the projects for uniting the Atlantic and Pacific oceans. Mr. Biddle is directed to proceed to Bogota for this purpose, and you will assist him in procuring any public documents that may have a bearing upon the subject, and, in particular, any contract that the government of New Grenada may have en-

tered into, under its law of the 22d May last, relative to a railroad across the isthmus of Darien.

You will afford to Mr. Biddle any other assistance, and any attentions and civilities that may be necessary, or that may be in your power.

I am, sir, your obedient servant,

JOHN FORSYTH.

ROBERT B. MCAFEE, esq.,
Charge d'Affaires of the United States, Bogota.

Extract of a letter from Mr. Clay to Mr. Williams, dated

FEBRUARY 10, 1826.

On the 8th of February last Mr. Cañaz, the minister of the republic of the Centre, addressed a note to the department, which affords a new and highly interesting proof of the friendly sentiments entertained by his government towards the United States. In that note, after calling the attention of this government to the important object of uniting the Atlantic and Pacific oceans by a canal navigation through the province of Nicaragua, by the direction of his government he offers to that of the United States to share in that great enterprise, and, by means of a treaty, perpetually to secure the advantages of it to the two nations. To that note an answer was transmitted on the 18th day of April last, and copies of them both accompany these instructions. From the perusal of the answer, without declining the friendly proposal, you will perceive that a decision upon it is postponed to the acquisition of further information; and you are desired to direct your attention particularly to that object. It will at once occur to you to ascertain if surveys have been made of the proposed route of the canal, and if entire confidence may be placed in their accuracy.

What is its length? what the nature of the country, and of the ground through which it is to pass? Can the supply of water for feeders be drawn from the lake Nicaragua, or other adequate sources? In short, what facilities do the country and the state of its population afford for making the canal, and what are the estimates of its cost? It is not intended that you should inspire the government of the republic of Guatemala with any confident expectation that the United States will contribute, by pecuniary or other means, to the execution of the work, because it is not yet known what views Congress might take of it. What the President desires is, to be put in possession of such full information as will serve to guide the judgment of the constituted authorities of the United States in determining, in regard to it, what belongs to their interests and duties.

Mr. Cañaz to the Secretary of State.

[Translation.]

WASHINGTON, *February* 8, 1825.

SIR: Among the various objects upon which the government of the republic of the Centre of America, which I have the honor to represent, has instructed me, that of promoting the opening of a canal for the communication of the Pacific and Atlantic oceans, in the province of Nicaragua, of the territory of that republic, has been most particularly recommended to me; and, desirous of fulfilling the high confidence which has been reposed in me, I wish to call the attention of the government of the United States of America to this interesting subject.

This project, which, viewed with respect to the possibility of its execution, does not exceed ordinary bounds, is, for the importance of the effects which it ought to produce upon the general prosperity of the two worlds, the most vast which has ever been conceived; and, although the omission of it ought to fill with shame the government which previously caused it, its execution will be a most glorious act for that which undertakes and brings it to the desired termination. I am certain that my government, when placed in better circumstances than the present, would not consent to part with the least portion of this distinguished honor; but it is in the first moments of its existence, occupied simultaneously in forming the institutions which must confirm its political government, and the quantity of force which is necessary to secure its preservation, and can neither distract its attention from these objects, nor employ its resources, which are still scanty, on those which are not of primary necessity.

But as its sentiments do not permit meanness, and its sincere desires are those of utility, it does not wish to retard longer the inestimable benefits which must be produced to the world by means of this great enterprise; and it has been resolved to consent to a foreign co-operation to render it effectual.

I ought to mention, sir, as the representative of the government of the Centre, that nothing would be more grateful to it than that this co-operation should be owing to your generous nation, whose noble conduct has been a model and a protection to all the Americas; and that, on these considerations, it will be highly satisfactory to have it a participator, not only of the merit of the enterprise, but of the great advantages which that canal of communication must produce, by means of a treaty, which may perpetually secure the possession of it to the two nations.

By the data which at present exist, there ought to be no doubt of the possibility of the work in the terms shown by the plan which I have the honor of sending you herewith. My government is disposed to employ all the means in its power to facilitate the execution; a company of respectable American merchants is ready to undertake the work, as soon as it is secured by a treaty between both governments; and, finally, if a diplomatic agent be

appointed by this government to the republic of the Centre, and if he be instructed upon the matter, the most favorable opportunity presents itself for the arrangement of this business.

In this case, sir, I hope that you will be pleased to let me know, that I may embrace the occasion of speaking a little more at large; because I am prepared to do what can be done on my part in the arrangement of this business, which I consider as of the greatest interest; and in the meantime receive the considerations of my respect, with which I have the honor to be your most obedient servant,

ANTONIO JOSE CAÑAZ.

Mr. Clay to Mr. Cañaz.

DEPARTMENT OF STATE,
Washington, April 18, 1825.

SIR: Your letter, under date at Washington, on the 8th of February last, was duly received at this department. The delay in answering it has proceeded from the termination of one, and the formation of another, administration. I rely upon your goodness to perceive, in the pressure of indispensable business necessary to that change, a sufficient apology for this delay.

Your letter has been submitted to the President, and attentively considered by him; and I am instructed to make known to you the very great sensibility with which he receives the expression of sentiments of consideration and friendship towards the United States which are entertained by the government of the republic of the Centre of America; and, at the same time, to assure you that they are most cordially reciprocated. The confidence of your government in that of the United States is strongly manifested by the highly important proposition which your note communicates. That proposition is, that the United States shall co-operate with the republic of the Centre in promoting the opening of a canal through the province of Nicaragua, to unite the Atlantic ocean to that of the Pacific, and that, by means of a treaty, the advantages of that canal may be perpetually secured to the two nations.

The idea has been long conceived of uniting those two seas by a canal navigation. The execution of it will form a great epoch in the commercial affairs of the whole world. The practicability of it can be scarcely doubted. Various lines for the proposed canal have been suggested, and have divided public opinion. The evidence, tending to show the superiority of the advantages of that which would traverse the province of Nicaragua, seems to have nearly settled the question in favor of that route. Still, on a project of such vast magnitude, it is necessary to proceed with the greatest caution. A false step, taken in the first movement, might lead to the most mischievous consequences. The President has, therefore, determined to instruct the chargé d'affaires of the United States, whom he has just appointed, (and who will shortly

proceed upon his mission to the republic of the Centre,) to investigate, with the greatest care, the facilities which the route through the province of Nicaragua offers, and to remit the information which he may acquire to the United States. Should it confirm the preference which it is believed that route possesses, it will then be necessary to consult Congress as to the nature and extent of the co-operation which shall be given towards the completion of the great work. The chargé d'affaires of the United States will be specially directed to assure your government of the deep interest which is taken by that of the United States in the execution of an undertaking which is so highly calculated to diffuse an extensive influence on the affairs of mankind, and to express to it also the acknowledgments which are justly due to the friendly overture of which you have been the organ.

I pray you to receive assurances of my highest and most respectful consideration.

H. CLAY.

Don Antonio Jose Canaz,
Envoy Extraordinary, &c.

Extract from a letter of Mr. Williams, chargé d'affaires of the United States to Central America, to Mr. Clay, dated 24th November, 1826:

On my journey, at San Vincente, 86 leagues east-southeast from this city, I met with Mr. Cañaz. He returned to the United States by the river San Juan and Lake Nicaragua. He entertains no doubt of the practicability of the contemplated canal.

Extract of a letter from Charles Savage, dated New Orleans, August 29th, 1830, *to his excellency Martin Van Buren, Secretary of State, Washington:*

General Verveer, his Netherland majesty's envoy to Central America, will probably obtain the grant for a canal through Nicaragua; his application had met with the approbation of the Executive, and the Congress will probably approve.

Extract from a letter of Henry Savage, acting consul of the United States at Guatemala, to Mr. Van Buren, dated September 3, 1830:

General Verveer arrived here in the beginning of March, 1829, with full powers of his majesty the King of the Netherlands. On his arrival, the country was in a most desperate state of civil dis-

sension; the city of Guatemala was blockaded by the combined forces of San Salvador and Honduras troops, under the command of General Morazan. The envoy of the Netherlands made an unsuccessful attempt to pacify the contending parties; and the city of Guatemala was taken on the 12th April, 1829. A temporary federal government succeeded the few weeks' administration of General Morazan, and with which it appears that General Verveer has not thought proper to enter into any negotiation about his mission; the main object of which is, undoubtedly, the project of opening the canal through Nicaragua.

However, as soon as the Congress of 1830 was assembled, General Verveer entered upon his business, and a commission was appointed by the Senator President to treat with him; the commissioners were the secretaries of state for foreign affairs and of the financial department, and the Senator Mendez; and a project was formed between them, which has not been made public till the present moment; however, I am informed, and I think upon very solid grounds, that the said project, now before the Congress, and presented to it on the 24th July last, contains, in substance, the following articles:

1st. The undertaking of the canal shall be offered to a society of the Netherlands, already existing; and agents for that purpose shall be sent off immediately.

2d. The canal shall be free to all nations at peace with Central America, without exception; and not even the Netherlands shall enjoy greater or other advantages over other nations.

3d. Armed ships shall not be allowed to pass through the canal, without the express consent of the government of the republic; and this permission shall never be granted to a flag at war with any other nation.

4th. The government of the republic is authorized to use all its endeavors to have the neutrality of the canal acknowledged by all European and maritime powers, not only to, but even a certain distance from, its mouth on both oceans.

5th. Private armed vessels and all slave traders are expressly prohibited passing through the canal, or to hover in the neighborhood of its mouth.

6th. The republic shall furnish, at its own expense, the ground on which the canal shall be opened; and freedom granted for the use of all raw materials on such grounds or in the neighborhood.

7th. The company shall furnish the plan of the execution of the canal, which shall be on the largest scale possible; at any rate, so as to admit our largest whalers. The execution, without intervention on the part of the government, is left entirely to the undertakers.

8th. The canal must pay the capital and the interest out of its own revenues; and the direction and administration of it to remain in the hands of the undertakers, as well as the receiving and managing of these revenues, until the whole debt of the canal shall be entirely paid off. As for the security of the capital, and interest with which it shall be charged, a mortgage is granted upon the lands at a league distance from both sides of the canal.

9th. The interest of the capital to be invested is fixed at ten per cent.

10th. The tariff for passage through the canal shall be regulated jointly by the government of the republic and the society, but in such a manner as to give it a decisive advantage over that made round Cape Horn.

11th. Out of the revenues must be paid the expenses of repairs and keeping, the direction of which remains entirely in the hands of the undertakers, but under a certain control on the part of the government.

12th. All foreigners who shall be employed in the construction of the canal, and afterwards, for their services shall be considered as guests of the nation; they shall be free from all contributions, and exempt from military service, and under the immediate protection of the agents of the nation to which they belong residing in Central America.

13th. The capital and all passive debts of the canal being paid up, the canal returns into the full possession of the government of the republic.

14th. A free commercial town shall be established in the neighborhood of the canal, which shall enjoy perfect freedom of religious toleration, the utmost freedom of commerce, and its own municipal administration; its inhabitants cannot be taxed by the government of the republic, nor forced to do military service. The town, however, remains under the sovereignty of the republic, as well as the canal.

15th. The whole establishment shall be recommended to the special protection of all the maritime and commercial nations of the world.

And this is all that I can ascertain now; but should I be able to acquire more information on the subject, I shall hasten to communicate the same to you. With the whole project, I think, is connected a loan, in favor of the republic, mortgaged upon the canal.

Extract from a letter of Henry Savage, acting consul of the United States at Guatemala, to Mr. Van Buren, dated December 3, 1830.

Great sensations are excited by the arrival of the news of the disturbances in Holland, and all seem to foretell the impossibility of carrying into effect the project of opening the canal by the Dutch government. All concur, and every one seems tacitly to look forward to the United States for the completion of this grand project. They say that the United States, identified in her institutions with this government, is the only power that ought to have the preference.

Extract of a letter from Henry Savage, acting United States consul, to the Secretary of State.

UNITED STATES CONSULATE,
Guatemala, August 10, 1831.

SIR: In my despatches of 3d September, 1830, I promised to forward any further intelligence in relation to the canal project that I might be able to obtain. I have now the satisfaction of submitting to your investigation the enclosed copy of the original basis of the treaty decreed by the National Congress, and which is to be made in Holland. It was lent to me with *much reserve*, and I availed myself of the opportunity to copy it myself; and, in order to avoid any misconstructions, I transcribe it in the original language for your information. I refrain from any observations, save a few remarks which I took the liberty to make, *in confidence*, to the person who favored me with the loan; and I objected to the 7th article of the 18th section, as regards citizens dying intestate without legal representatives, upon the ground that it was stipulated by our treaty of Washington, and that, so long as I had the honor of acting as consul, I should exact a strict compliance therewith. It is promised to me that that article shall be rescinded. I endeavored to persuade him of the error into which I conceived them to have fallen, as regards the stipulations of the 3d article of the 10th section, which binds the government in the engagement not to pay off the capital employed in the construction of the canal with foreign funds, (that capital bearing an interest of ten per cent.,) if they could at any future period obtain a loan equivalent for that purpose at a more reasonable rate. My argument convinced, as I believe; and the secret instructions to be given to the envoy to Holland are promised to be shown to me. I conceive the cession to the Dutch company, by the 4th article of the additional section, of the rights of the coasting trade, to be impolitic; and, as such, represented it; and I mentioned that, so soon as it was done, I should be the first to claim the same privileges for the citizens of the United States, by virtue of our treaty; that France had but lately intimated a wish to conclude a treaty of amity, commerce, and navigation with this government; that, England having manifested the same desire, I was confident these two maritime powers would not enter into a contract that did not place them upon an equality with the most favored nation; therefore, that which they considered as a temporary privilege granted to the subjects of his Netherland majesty would become common to all parties, and thereby would lose its character of a privilege, at the same time that the nation would be deprived of the exclusive advantage of the coasting trade, which all other nations are so careful to reserve to themselves. An amendment whereof is also projected, if, on further consideration, it should prove to be pregnant with such difficulties; and for which purpose the minister to Holland shall receive instructions.

A preliminary treaty of amity, navigation, and commerce was signed on the 14th April between this government and the envoy

of his Netherland majesty, and Holland is placed upon an equality, in relation to navigation and commerce, with the United States. In the treaty of the canal, which will be executed in Holland, there will be included the stipulation of a loan of three millions of dollars, to be paid to this government, and which is to be considered as part of the capital invested in the aperture of the canal, and to bear the same interest.

Translation of a decree of the Congress of Guatemala, relative to a canal through that country, from the Atlantic to the Pacific, upon the application of a company in the Netherlands; passed the 21st September and the 18th December, 1830.

Principles and instructions intended to serve as basis for negotiations to be carried on in the kingdom of the Netherlands, in the name and behalf of the republic of Central America, for the purpose of opening a communication between the Atlantic and Pacific oceans by a canal across the isthmus of Nicaragua, and for obtaining a loan, in virtue of a decree issued this day.

SECTION I.

General principles respecting the canal, its freedom, neutrality, security, and the jurisdiction to be exercised over it.

ART. 1. The Congress, in the name and behalf of the republic of Central America, declares that the intention to unite the waters of the Atlantic and Pacific oceans, by a canal across the isthmus of Nicaragua, is fixed and irrevocable. This great and important work is undertaken with the most liberal and philanthropic views. It will increase the happiness and prosperity of all nations, by advancing navigation, commerce, and industry, as well as arts, sciences, and civilization; and all its advantages will be enjoyed on the same terms by all, with the exception only of certain privileges which may be especially conceded in order to forward the completion of the enterprise.

ART. 2. The canal shall be open for the passage of all vessels except those belonging to nations with which the republic may be at war.

ART. 3. The slave trade can never be carried on through the canal. Vessels attempting it will be subject to the laws against piracy; and every slave entering the canal, or landed upon its banks, from that moment becomes free.

ART. 4. The republic retains its sovereignty over the canal, and over the ground which may be occupied for its use, security, or protection; also, over all colonies, cities, towns, villages, and establishments for trade, manufacture, wood-cutting, or any other purpose whatever, which are or may be situated on its banks and in its vicinity. The sovereignty will, however, be in no case ex-

erted in a manner contrary to the principles here expressed, or to the contracts and obligations into which the republic may enter for the execution of the work.

ART. 5. The Federal Congress, in the name and behalf of the republic, considering that the communication between the two seas, by the canal across the isthmus of Nicaragua, is intended for the use and advantage of all nations, without distinction, does hereby ordain and decree—

1st. No vessel of war or transport of troops shall be admitted into the canal, or either of its entrance ports, without the express consent of the government of the republic.

2d. No vessel of war belonging to a nation engaged in hostilities with another shall be suffered to remain in or pass through the canal.

3d. No vessel laden wholly or in part with arms, ammunition, or other articles known and considered as contraband of war, belonging or suspected to belong to a nation engaged in hostilities with another, shall be suffered to pass through the canal, either under the flag of such nation, or of a neutral engaged in supplying its enemies' fleets or ships, stationed or cruizing in either sea.

4th. No private armed vessel, or vessel bearing letters of marque and reprisal, shall be suffered to enter and remain in the canal, or in any bay, port, or gulf, sufficiently near to either of its extremities to compromise its actual neutrality.

5th. No vesrel of war, or transport of troops, arms, stores, or other articles considered as contraband of war, shall be allowed to pass through the canal, if any other nation or government which may be effected thereby have previously made a representation and request to that effect.

The Congress, with the view of rendering the communication between the two seas as useful and advantageous as possible to the commerce and industry of all nations, declares that no change or alteration shall be made in the principles here expressed, but that the government of the republic will maintain and defend them by every means in its power.

ART. 6. In order that the above intentions may be more certainly fulfilled, the supreme government of the republic solemnly engages and declares that it will employ the most effective and urgent means to procure from the governments of the several maritime nations of Europe and America, the acknowledgment of the most strict neutrality within a certain distance in every direction from either entrance of the canal; for the observance of which, at all times, and in all cases, the strongest guaranties will, if possible, be obtained from each government individually, and from the whole collectively.

ART. 7. The Congress, in the name and behalf of the republic, solemnly engages and declares that, should any changes, reform, or modification, hereafter be judged necessary, none will be made which can in any way affect the contracts or engagements into which the republic may enter for the construction of the canal and its dependencies.

ART. 8. The Congress, in the name and behalf of the republic, solemnly engages and declares that no convention, or treaty of peace, alliance, friendship, or navigation will ever be made with any foreign power, under any circumstances or conditions, by which the contracts and obligations entered into for the execution of the canal may be in the least infringed.

SECTION II.

Track and dimensions of the canal; engineers and officers to be employed; and the assistance to be afforded them by the republic.

ART. 1. The depth and width of the canal shall be sufficient, if possible, to admit the passage of the largest ships fully laden.

ART. 2. The government of the Netherlands, or those interested in the capital advanced for the execution of the canal, will select the engineers and other officers to be employed in surveying the track and drawing the plan of the intended works.

ART. 3. The plans, when drawn, are to be submitted for approval to the government of the republic, which will have the right of associating with said engineers and officers a certain number of citizens of the republic, who will examine into the details, and suggest the best means of removing obstacles.

ART. 4. Every possible facility will be afforded to the engineers and hydraulic officers by the supreme government, which will give orders to that effect to the local authorities, and lay open for inspection all maps, plans, accounts, propositions, and papers, relative to the subject, which are to be found among the archives of the republic.

ART. 5. The plans being approved, their execution will be confided without any obstacle or hindrance to the persons charged therewith. The government of the republic will, however, appoint and associate with said persons a commission of citizens of Central America, whose duty it shall be to inspect the operations, and see that they be conducted in accordance with said plans, and with the conditions previously agreed on.

SECTION III.

Administration and comptrollership of the capital to be employed in the construction of the canal.

ART. 1. The mode of raising the capital to be expended in the construction of the canal, shall be left entirely to the will of the persons in the Netherlands who undertake the work.

ART. 2. The administration and investment of the funds shall be left to those interested therein, or their agents or representatives, in Europe or America.

ART. 3. The company charged with the construction of the canal and its dependencies shall account to the government of Central America for the sums expended in the work. The form and man-

ner, and times of rendering these accounts, shall be settled and expressed in the contract.

Art. 4. The supreme government of the republic is to have the comptrollership of the expenses.

Art. 5. When the canal and its dependencies are completed, the sum total of the expenses shall be computed, and its accuracy acknowledged by a formal act of the republic.

Section IV.

The canal to be constructed at the expense of the contracting party.

Article 1. All expenses for labor, materials, tracing and drawing the plan of the canal, or any thing else relative to its construction, are to be borne by the contracting party, and repaid by the canal.

Section V.

Guaranties and securities for the interest and extinguishment of the debt contracted for constructing the canal.

Article 1. The Congress declares its wish and intention to afford every possible assurance and security to those interested in the capital to be expended on the canal and its dependencies, and authorizes the supreme government to enter into the most solemn engagements to that effect.

Art. 2. The collection and administration of the revenues of the canal (respecting which, see section 8) are to be entirely confided to the contracting party, until the whole of their capital and interest be repaid. From this revenue is to be deducted the sum necessary for the preservation of the canal; the remainder to be devoted entirely to the payment of the annual interest and the extinguishment of the debt.

Art. 3. As further assurance and security for the said capital and interest, a mortgage will be given upon all lands, the property of the confederation, or of the States thereof, with their wood, minerals, and all other productions whatsoever.

Art. 4. Besides the above general mortgage, a special one will be given upon the lands now belonging to the dominion, situated within a league from either shore of the canal, of its entrances, or of the lakes Nicaragua and Managua, and upon all the islands in said lakes, with their wood, minerals, and all other productions whatsoever; the whole to remain in pledge until the complete extinguishment of the debt.

Art. 5. The lands and islands mentioned in the above article cannot be sold, rented, or alienated in any way, without the consent of the general directory of the canal; and in all such cases, the profits therefrom arising will be received by the administration of the canal, which shall keep an account thereof; and if in any year the receipts of the canal have been equal to the sum of the interest, the instalment for the extinguishment of the debt, and the current

xpenses of the canal, the above mentioned profits from sales, rents, c., shall be paid into the treasury of the republic.

ART. 6. The general directory of the canal may acquire possesion or use of the above mentioned lands upon the same conditions s any other persons or bodies.

ART. 7. Neither the canal nor its property, income or privileges, an ever be mortgaged, pledged, or otherwise rendered responsible or any debts or obligations contracted before or after its completion, by the confederation of the States, or any other authority whatsoever. This article applies particularly to the negotiations for a loan entered into between the republic and the house of Barclay, Herring, & Co., in 1824, and those subsequently with Messrs. Reid, Herring, & Co.

SECTION VI.

Ground, lakes, rivers, materials, &c., to be ceded for the construction, preservation, and police of the canal.

ARTICLE 1. The republic cedes, without indemnification, the ground, lakes, and rivers which may be required for the construction of the canal, as also the ground on its banks and at its entrances, for its repairs, preservation, and administrative police. The use of the rivers and lakes is, however, granted to no greater extent than may be necessary for the supply of the works and the navigation of the canal.

ART. 2. The republic will take upon itself entirely the charge of indemnifying the proper owners of the ground which may be employed in the construction and repairs, or for the administration and police of the canal.

ART. 3. All the timber, stone, lime, and other materials of every description required for the canal, for the habitation of the laborers, mills, machines, stores, and buildings destined for its use and advantage, may be taken, without indemnification, from the national forests and property, by order of the general directory of the works.

SECTION VII.

Expenses to be borne by the canal and property mortgaged after its completion.

ARTICLE 1. The expenses to be borne by the canal and property mortgaged after its completion, are, in general terms, all those for labor and materials employed for its use, preservation, police, and administration. Those for pilotage and towage are not, however, included in the above.

ART. 2. The expenses to be borne by the canal, as distinguished from those at the charge of the persons furnishing the capital, will be more particularly designated in the contract.

Section VIII.

Tariff of tolls and transit duties; administration, receipts, and payments, after the completion of the canal.

Article 1. The tolls and duties upon passage through the canal shall be fixed according to a tariff which will be inserted in the contract for its construction. The government and the general directory will jointly determine upon what basis this tariff shall be formed—whether on the tonnage of the vessel, the value of its cargo, or both together; or any other which they may think best.

Art. 2. In whatever way the tariff be formed, it must be remembered that its object is the assurance of an annual revenue sufficient for—

1. The preservation of the canal.
2. The regular payment of the whole interest upon the capital advanced for its construction.
3. The payment of the instalment agreed upon for the extinguishment of the debt, and the expenses accruing therefrom.

Art. 3. After the assurance of a revenue sufficient for the purposes detailed in the preceding article, the most important object to be kept in view, while fixing the tariff, is the encouragement of navigation through the canal, and causing it to be preferred to a passage around Cape Horn or the Cape of Good Hope.

Art. 4. After the tariff has been fixed according to the mode designated in the preceding articles, no increase or diminution can be made in its rates, without the common consent of the government of the republic and the general directory of the canal; and the circumstances under which such alteration may be proposed are to be specified in the contract.

Art. 5. The congress, in the name and behalf of the republic, declares that, until the entire extinguishment of the debt contracted for the construction of the canal, neither the confederation, nor the States, nor any other authority whatever, can impose upon the vessels or cargoes which pass through said canal any other duties or tolls than those expressed in the tariff, as contained in the contract, or established since, with the common consent of the government and the general directory of the canal.

Art. 6. As the police, direction, and administration of the canal, by article first of section seventh, belong to, and are at the charge of, the persons interested in the capital advanced, so, after its completion, is the administration of the receipts and payments to be confined entirely and exclusively to the same persons, or to their agents and representatives in the Netherlands, or in America, until the complete extinguishment of the debt.

Art. 7. In like manner as, by the fourth article of the third section, the comptrollership of the expenses incurred during the construction of the canal is vested in the supreme government, so does it reserve to itself the same comptrollership over the receipts and payments made after its completion. The manner and forms according to which this comptrollership is to be exercised will be expressed in the contract.

Section IX.

Interest to be paid on the capital advanced out of the receipts from the canal, and the property mortgaged for its security.

Article 1. The supreme government is authorized to allow an interest of ten per cent. per annum upon the capital advanced, to be paid out of the revenues from the canal and its securities, after its completion.

Art. 2. An interest of ten per cent. per annum will also be paid on all capital employed in works necessary for the perfection or amelioration of the canal, which are not laid down in the original plan.

Art. 3. The period from which the said interest shall begin to be reckoned is to be expressed in the contract.

Art. 4. If, contrary to all probability, the payment of the interest should ever be delayed for more than six months after due, from a *deficit* in the receipts of the canal and securities, a further interest of three per cent. per annum, or a quarter per cent. per month, will be allowed upon all such interest delayed, to be reckoned from the termination of the six months after due, until the original interest be paid.

Section X.

The debt to be extinguished by the revenue from the canal and its securities.

Article 1. The debt contracted for the execution of the canal is to be extinguished by annual payments out of the revenue arising from it and from its securities, in the manner and proportion which shall be fixed and expressed in the contract.

Art. 2. In the same contract, the manner and conditions upon which the debt may be extinguished by payment of a larger sum than that agreed on shall be expressed and fixed.

Art. 3. The supreme government, moreover, binds itself to employ no foreign funds in the extinguishment of the debt, without the consent of those interested in the capital, or their agents and representatives.

Section XI.

Disposition of the receipts from the canal and from the property mortgaged as security for the repayment of the capital.

Article 1. The receipts from the canal and property pledged in security are destined annually—

1. For the preservation of the canal, its use, administration, and police.

2. For the regular and entire payment of the interest on the capital advanced for its construction.

3. For the extinguishment of the debt.

ART. 2. The remainder of the receipts from the canal and property mortgaged, after the complete fulfilment of the conditions of the preceding article, shall be divided into two equal parts—of which the one shall be paid into the treasury of the republic, the other be destined as a reserve for unexpected or incidental expenses of the canal. The *maximum* of this fund, and the security to be given for its preservation, will be expressed in the contract.

ART. 3. The *maximum* of this reserve being attained, the surplus receipts from the canal and property mortgaged shall be paid into the treasury of the republic.

SECTION XII.

Settlement of accounts, and payment of dividends to the supreme government of the republic.

ART. 1. The manner and form in which the accounts of the general directory of the canal are to be annually rendered to the supreme government, as well as those of the payment of dividends to the republic, according to the second and third articles of the eleventh section, shall be fixed and expressed in the terms of the contract. The supreme government will give proper instructions to its agents in the Netherlands, who will see that the rights and duties of the republic are both accurately defined.

SECTION XIII.

Direction, administration, preservation, and police of the canal after its completion.

ART. 1. After the completion of the canal, and when it is ready for the passage of vessels, its direction, administration, and police will be confided entirely, exclusively, and without the interference of any other authority, to the persons interested in the capital expended on it, or their agents and representatives in the Netherlands and America; to be held by them until the complete repayment of such capital and the interests on it.

ART. 2. The supreme government will, however, reserve to itself the right of enforcing the execution of the conditions under which the canal is to be opened for the passage of vessels, as well as the right of inspecting the direction, administration, police and navigation.

SECTION XIV.

Articles required in constructing the canal, or for its preservation to be admitted free of duty; no duty or tax to be laid upon the exportation of the capital or the interest thereon.

ART. 1. All tools and instruments, materials, raw or manufactured or other articles necessary for the construction or preservation of

the canal, shall be admitted free of any duty of importation, transit, or consumption, which has been or may hereafter be laid upon such articles, either by the Confederation or by the States thereof.

Art. 2. No duty or tax shall be laid upon the exportation of the capital repaid, or the interests thereon, whether such capital or interests be carried out of the country in specie or productions.

Art. 3. For the purpose of facilitating the progress of the work and giving encouragement to the laborers, the general directory will have the right of importing articles of clothing and other necessaries for said workmen, on payment of not more than half the established duties upon the same. The quantity of such articles which may probably be required will be stated in the contract.

Section XV.

Inspection and police of the lakes and rivers, and other places from which water may be taken for the supply of the canal.

Art. 1. The inspection and police of the lakes, rivers, and all other places from which water may be taken for the supply of the canal and its dependencies, are to be committed exclusiuely to the general directory. This article, however does not give the right to prohibit fishing in said waters, or any other use thereof which may not be prejudicial to the progress and security of the works.

Art. 2. The local authorities, both civil and military of the Confederation and of the States, will always, when called upon, assist the general directory in enforcing obedience to the regulations which may be made with respect to the above-mentioned articles.

Section XVI.

Defence and protection of the canal.

Art. 1. To the supreme government of the republic alone is committed the charge of defending the canal, its dependencies, and property, and of protecting the persons who may be engaged in the construction, direction, or administration thereof; consequently, the said government retains the exclusive control over the troops and materials of war which may be thus employed, and the right of conducting the defence according to its own ideas and wishes.

Art. 2. The supreme government of the republic, will, moreover, employ any other means of defence which prudence or circumstances may suggest.

Section XVII.

Pilotage and towage of vessels on the canal.

Art. 1. In order to encourage the transit through the canal, the persons interested in the capital employed in constructing it shall

have the exclusive right of piloting vessels, and of towing them through it, by any means which they may think proper.

Art. 2. The persons furnishing the capital, or their representatives, may sell or lease the privileges ceded by the foregoing article, as they may think proper: provided, however, that such transfer be not made to any persons who are natives or inhabitants of a country with which the republic of Central America may at the time be at war.

Art. 3. The right of pilotage in both oceans, and in the lake of Nicaragua, will belong exclusively to the persons who furnish the capital employed on the canal.

Art. 4. The general directory will engage to employ the inhabitants of the country in piloting and towing, as far as possible; they will also engage specially to educate and train in those services a certain number of youths, who will be recommended to them by the government.

Art. 5. The right of piloting and towing being granted, in order to encourage the enterprise, the proceeds therefrom will not be included among the revenues from thn canal.

Section XVIII.

Rights of strangers employed on the canal.

Art. 1. The supreme government of the republic declares that all foreigners employed on the canal, both before and after its completion, will be considered as the guests of the Central American nation.

Art. 2. They will remain under the protection of the laws and guaranties of the republic, and of all the civil and military authorities of the confederation and the States.

Art. 3. They will, likewise, while employed on the canal, be under the protection of the agents of their native country resident in the republic, and particularly under that of the representative of the Netherlands.

Art. 4. They will be at liberty at any time to quit the territories of the republic, with their families and property. The necessary passports will be sent to them, immediately on their demand, provided no opposition be made thereto by the general directory, upon the score of agreements entered into with them, or of debts contracted by them in the country.

Art. 5. They shall never be called upon to perform any public service, without their own consent, and that of the general directory of the canal.

Art. 6. No personal tax, either ordinary or extraordinary, shall ever be laid upon them.

Art. 7. Whenever a foreigner employed on the canal dies, without leaving a will, or when his heirs, either natural or designated, are not present, his effects shall be surrendered into the charge of the general directory of the canal.

Art. 8. The general directory of the canal shall appoint a jury

for the trial of foreigners employed in its service, under the following circumstances:

1. In all questions relative to contracts and obligations into which they had entered, either in Europe or America.

2. In all cases of mutiny, sedition, and insubordination towards their superiors employed on the canal.

3. In all cases of malversation, or improper performance of duties.

4. In all cases of desertion, leaving work, or refusing to comply with the obligations entered into with the general directory, or other act prejudicial to the interests of the canal.

5. The supreme government is to be informed of the regulations which the general directory may form in these respects; no opposition will, however, be made by the former to their execution.

ART. 9. The jury thus constituted can order no other punishment than fine, imprisonment not exceeding two months, and banishment of the delinquent from the country.

ART. 10. Whenever a more serious punishment is required by the nature of the crime, the guilty person shall be delivered over to the tribunals of the country; before which the general directory will lay the affair, and support the prosecution.

ART. 11. Whenever a delinquency has been committed by a foreigner employed on the canal, which does not affect the interests of the canal, the guilty person shall be tried by the tribunals, and according to the laws of the country.

ART. 12. Every person employed as a superintendent of the work shall have the right, upon his own responsibility, of arresting and delivering over to the jury any individual placed under his command.

ART. 13. Every foreigner who, while under engagements to work on the canal, deserts and leaves his employment, may be seized, at the demand of the general directory, in any part of the republic, and delivered up to it.

SECTION XIX.

Concerning the employment of citizens of Central America as laborers on the canal.

ART. 1. For the benefit of the republic, as well as of the persons interested in the capital, the supreme government will employ the most effective means of procuring a constant supply of laborers, especially diggers, in order that the canal may be completed as soon as possible.

ART. 2. The supreme government will give the requisite orders and instructions for that purpose to the governors (géfes) of the several States, particularly of Honduras and Costa Rica.

ART. 3. The supreme government, jointly with the governors (géfes) of Nicaragua and the adjacent States, will use every possible means to effect the execution of this great undertaking in as

short a time as possible, to preserve the canal when finished, and to advance its interests.

Art. 4. It being proper that a uniform system should be adopted with respect to the laborers on the canal, the general directory will draw up a series of regulations for the conduct of those who may be citizens of the republic, which must be submitted to the government, and by the latter to the Congress, for their approbation.

Section XX.

The supreme government is empowered and recommended to use every means to induce the undertaking of the canal.

The Congress of the republic considering that the projected communication between the two seas, suggested by the hand of nature herself, will draw near together nations as yet separated by immense distances, and will prove of the highest advantage to the old as well as to the new world; that, from these circumstances, an immense population must, in a short space of time, be attracted to this most beautiful portion of the American continent, and, independent of all other advantages offered by so noble a monument of human industry, the country on the banks of the canal be made to yield not only metals, but likewise the vegetable productions of both hemispheres, on account of the varieties of climate caused by the gradual elevation of the surface: in order that such expectations may be realized—

Art. 1. The Congress authorizes the supreme government to employ, in its negotiations with the Netherlands, the most effective means of favoring the undertaking of the canal and its prompt execution.

Art. 2. The general directory of the canal shall have the exclusive right of cutting wood over a vast extent of territory, taken along the shores, or at one of the entrances of the canal, or on some part of the coasts and islands of the republic.

Art. 3. The situation and extent of the territory over which wood may be thus cut, will be determined by an express act, which the government is from this day authorized to make, when necessary, in the sense most liberal and most favorable to the undertakers. The territory thus ceded, with its inhabitants, will, however, remain forever under the sovereignty of the republic.

Art. 4. The supreme government is also authorized to grant every indulgence and freedom consistent with the laws, to the company which may complete the desired union between the two oceans.

Section XXI.

A free commercial city to be established in the vicinity of the canal.

Article 1. A free commercial city will be founded on the banks or at one of the entrances of the canal.

Art. 2. This city shall form a part of the republic, and be under the protection thereof.

Art. 3. The Congress, in organizing the system of laws for this city, will constantly keep in view, and endeavor to secure, freedom of religious worship; the greatest degree of freedom in trade; a municipal government, with trial by jury; exemption from military service out of the city.

Additional section.

Article 1. Any increase, extension, or improvement of the canal, not comprehended in the plan which may be first drawn up for its execution, and the expense of which will not exceed $20,000, may be carried into effect by the general directory. Should the expense be greater, the general directory will make a report to the supreme government, accompanied by plans and estimates. All expenses occasioned by such additions to or improvements of the canal shall be added to the capital. The works for the preservation and reparation of the canal are not to be regarded as *improvements*, and will be left entirely to the will of the general directory, according to the terms of article 2, No. 1, of the 8th section.

Art. 2. When the contract for the canal expires, in consequence of the repayment of the capital and other debts contracted for its execution, if the government should choose to make any new arrangement for its administration, direction, or use, it is hereby authorized to enter into an obligation to make the first offer to those who had contracted for the work, or their representatives. The members of the company first formed will at least be placed on a par with any others to whom the proposal may be made.

Art. 3. In no case, and under no circumstances, can the property of the persons interested in the enterprise, or that of the general directory, or any articles destined for the use of the canal, be required or employed for any military or civil purpose whatever, without the entire consent of the directory first obtained, and full indemnification allowed.

Art. 4. All vessels belonging to the company, and employed either during peace or war, on the canal, the coasts, or in the oceans, shall be considered as national, and have the same privileges, whether sailing under the flag of the Netherlands, or under that of the republic.

Art. 5. A clause shall be inserted in the contract specifying in what manner difficulties which may arise respecting the sense of any portion thereof may be amicably settled; whether by arbitration; and, if so, who shall be the arbiter.

Art. 6. Should the canal, from any insuperable difficulty, never be completed so as to afford a free passage for vessels between the two seas, the republic of Central America is not to be liable for any indemnification whatever to those who undertook it.

Art. 7. The Congress recommends that provision be made in the contract for the erection of a monument, with inscriptions

commemorative of the gratitude of the republic towards a prince who has given such proofs of his friendship towards the republic.

ART. 8. The Congress, finally, considering that it is impossible to foresee every circumstance which should have been provided for in the contract, and might serve to forward the work, and that the omission of such might be injurious thereunto; that it is its intention to observe punctually all the propositions herein contained; and that doubts may arise as to the interpretation of certain parts of this project, does hereby authorize the supreme government, jointly with the senate, to determine the sense of said passages, and to supply such defects in the language of the project.

ART. 9. The Congress declares that it must be expressly stipulated in the contract that all privileges, securities, and rights of intervention which may hereby be secured to the parties contracting for the execution of the canal, shall cease at the moment when the republic shall have completed its engagements, by repaying the capital and interests expended on the enterprise.

Office of the secretary of Congress, the twenty-first day of September, one thousand eight hundred and thirty.

JUAN RODRIGUEZ.

E. M. LARVARE.

Hall of the senate of Guatemala, the eighteenth of December, one thousand eight hundred and thirty.

M. PARDO, *President.*

The Executive:
J. BARRUNDIA.

Extract of a letter from Mr. Livingston to Mr. Jeffers, dated July 20, 1831.

It is understood that a Dutch company are in negotiation for the privilege of constructing a ship canal from the Atlantic to the Pacific oceans, through the river San Juan and the lakes Nicaragua and Leon, in the province or state of Nicaragua. From the letter of Mr. Savage it would appear that this privilege had been already granted, and that the conditions are such as we should have no great reason to complain of. But as his information, both as to the conclusion of the act and the conditions on which it is made, may be erroneous, it is a matter of great solicitude with this government to be assured that, in this important concern, its interests and its rights have not been neglected. You will, therefore, make it one of your earliest concerns to ascertain whether any such privilege has been granted; and, should you find it to be the case, to procure an authentic copy of the act, and send duplicates by the first conveyance to this department. Should you find, on inspecting the act, that particular privileges or facilities are given to the amount of toll, tonnage, or other duties of charges,

to the vessels or merchandise of any foreign power, greater than those which the vessels or merchandise of the United States would enjoy, by the terms of the act, in passing through the canal, or in the ports at its termination, you will immediately signify to the government that the United States consider themselves, by the terms of the treaty, as entitled to the same advantages.

Should the grant not be completed, you will endeavor to procure for the citizens of the United States, or for the government itself, if Congress should deem the measure constitutional and proper, the right of subscribing to the stock; and you will, in either case, procure and transmit such plans, estimates, and other information relative to the projected work, as may enable us to judge of its feasibility and importance. The depth of water, safety from storms, capacity, and other facilities of the projected ports, at the two extremities of the canal, are particularly important to be known, as well as the intended length, breadth, and depth of the canal itself, and the time calculated for constructing it.

The ports, inlets, rivers, and other facilities for external commerce on both seas, are not known or laid down on any charts with sufficient accuracy. It will be useful, if any surveys have been made by the order of the government, or by individuals, to procure copies of them; and when such do not exist, or cannot be procured, to get such information as you think can be relied on, and forward it to this department, with the mode and cost of transportation from the ports to the interior, and across from one sea to another. One object of the last inquiries is to determine whether, without the facility of a canal, the charge of transportation, unshipping, and reshipping would or would not give to the passage across the isthmus any advantage in the East India trade over the usual route. Connected with this subject would be the inquiry, what quantity and value of the commodities of the Philippines, China, or the East Indies, would be consumed in the republic, or the adjacent parts of Colombia and Mexico.

Extract from a letter of Mr. McAfee to Forsyth, dated.

BOGOTA, *March* 21, 1836.

On the 13th instant Colonel Biddle arrived in this city from Panama, and presented to me your despatch No. 24, and is now with me in company with Dr. Gibbon; and, on the 15th instant, I introduced him to Mr. Pombo, to whom he explained his business; and, on the 16th, we called upon the President, by whom, and the minister, Mr. Pombo, he was received in the kindest manner. On my part, I will render him every aid and assistance in my power, and I have great hopes of his succeeding in his views as to a road or canal across the isthmus of Panama, as he is well qualified to manage this business.

Extract of a letter from Mr. McAfee to the honorable John Forsyth, Secretary of State of the United States, dated

BOGOTA, *June* 30, 1836.

I now enclose you my correspondence with this government in relation to Colonel Charles Biddle's proposition to make a road across the isthmus of Panama, which eventuated in the passage of a decree of the Congress for that purpose, and the conclusion of a contract with Colonel Biddle and his associates on the 22d instant. This road (if completed upon the plan contemplated) will be of immense importance to the commerce of the United States, and, indeed, to the whole commercial world; and, with this view of the case, every necessary aid within my power was given. But, as Colonel Biddle will report to you his proceedings, I deem it unnecessary to add more upon this subject.

Mr. McAfee to Mr. Pombo.

LEGATION OF THE UNITED STATES,
Bogota, March 17, 1836.

SIR: The undersigned, *charge d'affaires* of the United States, has the honor herewith to enclose to your excellency, for the information of the government of New Grenada, a copy of a letter addressed to him by Colonel Charles Biddle, *special agent* of the United States, charged with the duty of examining into the practicability of constructing a road or canal across the *isthmus of Panama*, and other important works connected with the future commercial intercourse between the two countries. The undersigned is instructed by his government to render to Colonel Biddle every necessary aid and assistance; and the enclosed letter is submitted to the consideration of your excellency, under the hope that it will meet the approbation of the government of New Grenada; in which event, Colonel Biddle will submit his propositions in detail.

With renewed sentiments of high respect, the undersigned is your excellency's obedient servant,

ROBERT B. McAFEE.

His Excellency Señor LINO DE POMBO,
Minister of Foreign Affairs, &c.

Mr. Gonzalez to Mr. McAfee.

[Translation.]

DEPARTMENT OF THE INTERIOR AND FOREIGN RELATIONS,
REPUBLIC OF NEW GRENADA,
Bogota, March 27, 1836.

The undersigned, secretary of the interior and foreign relations of New Grenada, has the honor to inform the chargé d'affaires of

the United States that he has submitted to the president of the republic the note addressed by the charge d'affaires on the 17th instant to Señor Lino de Pombo, stating that he had been instructed by his government to lend to Colonel Biddle all the aid and assistance in his power to promote the contemplated enterprise of a communication between the two oceans, across the isthmus of Panama, and other internal improvements. The President has been likewise made aware of the contents of the letter enclosed in the said note, and of a document presented directly to his excellency by Colonel Biddle yesterday, setting forth the terms and conditions on which he will carry the enterprise into effect.

His excellency has viewed these documents with great interest, and has instructed the undersigned to make known to the chargé d'affaires his disposition to favor the project of Colonel Biddle, as far as lies within his powers, and as far as they may be compatible with the laws and interests of the nation. In order that the affair should proceed with regularity, it will be proper for Colonel Biddle to make each proposition relative to each enterprise separately, as there is one which requires the preliminary determination of the Executive, and others which depend on the will of Congress. It is also proper that no time should be lost in so doing, as the legislature will only sit about sixty days longer, if they are prorogued at the period allowed by the constitution. Fortunately, the chargé d'affaires has received a copy of the law of May 25th, 1834, authorizing the Executive to enter into a contract for opening a road in the isthmus of Panama; and another law of the 29th of May, 1835, granting to Baron de Thierry the privilege of opening a canal at the same place, before the chargé d'affaires saw that the Executive could receive the proposition of Colonel Biddle for making the road; and to this must be reduced one of the projects presented, in order that the negotiation may begin. The other propositions, respecting the privilege of navigating the Chagres by steamboats, and of opening a road from Carthagena to the mouth of the river Cauca, can only be accepted by the legislature, and must also come in separate forms, with their respective explanations, to the Chambers.

As it would be difficult to give, in this note, all the explanations necessary for rendering the propositions most clear and precise, as well as the ideas of the government, in case the chargé d'affaires should desire to examine them, the undersigned will be happy to have a conference with him on any day and hour which he may name.

The undersigned renews to the chargé d'affaires the assurances of his distinguished consideration.

FLORENTINO GONZALES.

To the Hon. R. B. McAfee,
Chargé d'affaires of the United States of North America.

Mr. McAfee to Mr. Pombo.

LEGATION OF THE UNITED STATES,
Bogota, May 24, 1836.

SIR: The undersigned, chargé d'affaires of the United States, has the honor to enclose to your excellency a communication from Colonel Biddle, in which he offers the most ample guaranty for the completion of a road across the isthmus of Panama; and the undersigned, being instructed by his government to render to Colonel Biddle every necessary aid, has no doubt of his ability and intention to carry this important work into complete operation, and that he can give to the government of New Grenada any additional security which may be required. It is to be hoped that so fair a prospect of adding to the prosperity and glory of this government may not be frustrated on account of a mere difference of opinion as to the plan of operation.

With sentiments of high respect, the undersigned is your most obedient servant,

ROBERT B. McAFEE.

His excellency LINO DE POMBO,
Minister of Foreign Affairs, &c.

Mr. Pombo to Mr. McAfee.

[Translation.]

DEPARTMENT OF INTERIOR AND FOREIGN RELATIONS,
REPUBLIC OF NEW GRENADA,
Bogota, May 25, 1836.

The undersigned, Secretary of State of the Interior and Foreign Relations, has the honor to acknowledge the receipt of the note addressed to him yesterday by the chargé d'affaires of the United States of North America, enclosing one from Colonel Charles Biddle, in which he offers security of one million of dollars, to be paid in case the road be not opened across the isthmus of Panama; for which a privilege has been granted to him by the Legislative Chambers, in a projet of a decree now pending.

With assurances of esteem and consideration, the undersigned remains the most obedient servant of the honorable chargé d'affaires.

LINO DE POMBO.

Hon. ROBERT B. McAFEE,
Chargé d'Affaires of the United States of North America.

Mr. Forsyth to Mr. Biddle.

DEPARTMENT OF STATE,
Washington, July 19, 1836.

SIR: Since your letters from Havana, those from Kingston, Jamaica, of the 8th and 13th November; from Panama, of the 7th, 16th, and 29th December, 1835, and 18th January, 1836; and from Bogota, of the 15th and 24th March last, have been received. The papers that accompanied them were already in the possession of the department. Of the progress which has been made in the errand upon which you were sent, the department is ignorant. The newspapers inform us that you had contracted, on your individual account, for the grant of an exclusive privilege for an avenue across the isthmus of Panama; and it is therefore probable this letter may reach you in Bogota. It is desirable to receive a full report on the business entrusted to you, which you may commit to the care of Mr. Early, on his return to the United States; and also to be informed when you may be expected in Washington.

I have the honor to be, sir, your obedient servant,

JOHN FORSYTH.

CHARLES BIDDLE, Esq., *Bogota.*

Mr. Forsyth to Mr. McAfee.

DEPARTMENT OF STATE,
Washington, September 23, 1836.

SIR: Your despatch of the 30th June, 1836, has been received, and, among the documents accompanying it, a copy of your correspondence with the government of New Grenada, in relation to Colonel Charles Biddle's proposition to make a road across the isthmus of Panama, which you state eventuated in the passage of a decree of the Congress for that purpose, and the conclusion of a contract with Colonel Biddle and his associates on the 22d of June.

Upon perusing this correspondence, it was observed with surprise that you had recommended to the government of New Grenada, in your official character, a private proposition of Colonel Biddle, which was wholly unauthorized by this government.

Colonel Biddle was sent out by the President as a special agent of the United States, for the purpose of *making observations and inquiries, and collecting documents*, relative to the establishment of a communication between the Atlantic and Pacific oceans, by means of a railroad or canal across the isthmus of Panama; and so you were substantially informed in the note addressed to you on the 1st of May, 1835. The powers which he derived from this government extended no farther, and the assistance which you were desired to render him in your official capacity was obviously confined to the objects of his agency.

Although a private citizen of the United States may have the right to enter into contracts with foreign governments, it is not al-

lowed to a diplomatic representative of this country to lend, on such occasion, the aid of his official sanction, without express instructions to that effect from this department. Your communications, therefore, to the authorities of New Grenada, recommending the proposition of Colonel Biddle above alluded to, are strongly disapproved; and you will so inform that government without loss of time. You will also distinctly state, that the only object of Colonel Biddle's agency was to *obtain information*, for the purpose of enabling the President to judge of the practicability and utility of a railroad or canal across the isthmus of Panama; upon which points he has as yet formed no determination; and that the proposition of Colonel Biddle, to which your notes alluded, was made without the participation or authority, and without the knowledge, of this government.

It is not intended by what has been said to object to Colonel Biddle, or any other citizen of the United States, in his private capacity, becoming a party to a contract with the government of New Grenada; nor is it intended to impair the confidence which in the present instance may be reposed in the ability of Colonel Biddle to fulfil his engagements, so far as it may depend upon his private means and those of his associates; but only to disclaim all connexion with the project on the part of this government, and to prevent any misunderstanding upon that point, by the government of New Grenada, from what has taken place.

I am, sir, your obedient servant,

JOHN FORSYTH.

ROBERT B. MCAFEE, Esq.,
Charge d'Affaires of the United States at Bogota.

Mr. Biddle to Mr. Forsyth.

PHILADELPHIA, *September* 25, 1836.

SIR: I arrived at New York on Tuesday last from Carthagena, and should ere this have been in Washington, but for an accident on the railroad which precludes me from travelling. In a few days I hope to pay my respects to you in person.

I have the honor to be your obedient servant,

CHARLES BIDDLE.

Hon. J. FORSYTH.

Mr. Forsyth to Mr. Biddle.

DEPARTMENT OF STATE,
Washington, September 26, 1836.

SIR: Your return to the United States has been announced by the newspapers; but as no communication has been received from

you since that dated at Bogota, on the 24th March last, the department is not informed how far you have been able to accomplish the object for which you were sent as a special agent of the United States. A report, in pursuance of your instructions, is expected without delay, and the transmission of your account for settlement.

I have the honor to be, sir, your obedient servant,

JOHN FORSYTH.

CHARLES BIDDLE, Esq., *Philadelphia.*

Mr. Biddle to Mr. Forsyth.

(Received *November* 15, 1836.)

SIR: Immediately after the receipt of your instructions dated May, 1835, I left Washington city, and proceeded to Philadelphia and New York, in order to obtain, from books and verbal communications with gentlemen who had personal knowledge of South America, such additional information as I could procure relative to the country I was about to visit. I can now safely assert that the information thus received, although derived from the most respectable sources, fully justifies that paragraph of your instructions which states that "the published accounts of the regions you will visit are scanty and imperfect."

The commercial intercourse between the United States and the Chagres river is so extremely limited as to render it difficult to obtain a direct conveyance to the latter place; and I was consequently compelled to adopt that course which appeared most expeditious, although not the most agreeable or direct.

I flatter myself, however, that my detention at Cuba will be considered as amply compensated by the great mass of information, already communicated to you, relative to that highly interesting country. The views which I have taken, of the social and political condition of the colony, are founded upon the most authentic information, and may be confidently relied upon.

On the 27th November I reached that point of the isthmus from whence it appeared most desirable to commence my researches.

By reference to a manuscript map which accompanies this letter, (marked A,) you will perceive a town called *Chagres*, at the mouth of a river of the same name emptying into the Atlantic ocean between eight and nine degrees of north latitude. From that place to *Cruces*, by the various windings of the river, the distance is represented, in a Spanish survey made by order of the government in 1734, to be forty-three miles. This river is navigable at all seasons of the year for steamboats drawing from five to six feet water; and as the current does not exceed three miles per hour, the trip could be performed from Chagres to Cruces in five hours. From Cruces to Panama is fifteen miles, over a region of country presenting no greater difficulties for a railroad than that from Washington to Baltimore. In this way there can be secured, by

steamboats and railroad cars, *a safe conveyance from the Atlantic to the Pacific ocean in six hours.*

With the most perfect conviction of the facility with which this enterprise could be accomplished, I arrived at Panama on the first day of December, where the lively interest felt in the design of my visit procured me an enthusiastic reception. I found that all confidence in the Baron Thierry was destroyed, and his scheme condemned as impracticable. The members of Congress recently elected were lamenting the decay of commerce in the isthmus for want of good roads; and so dejected as to their future prospects, that they had decided not to attend the approaching session of Congress at Bogota.

The Society of Friends of the Country (which includes among its members the most talented, wealthy, and influential men of the isthmus) commenced a correspondence with me, which they subsequently published in pamphlet form, of which a copy is annexed, marked B. The result of that correspondence was a revival of their hopes, and a determination, on the part of the members of Congress, to accompany me to Bogota, where we arrived on the 13th of March, after a most tedious and fatiguing journey of fifty-four days. On the 16th of March I addressed a letter to General McAfee, a copy of which is annexed, marked C; which letter was transmitted to the executive of New Grenada, and by him communicated to Congress. The House of Representatives referred the whole subject to a special committee, who, after several interviews with me, made a report, a copy of which is annexed, marked D.* After a debate in Congress, which occupied 38 days, the decree passed both Houses, without any material alterations from that reported by the committee.

A practice prevails with the Congress of New Grenada of requiring from the executive officers their personal attendance, in order to explain their views upon all important subjects of legislation. In the present instance, the Senate was exclusively engaged eight days in listening to the speeches of Messrs. Pombo and Soto, the Secretaries of State and Treasury. On the 18th day of May, the decree finally passed both Houses of Congress, and was transmitted to the President, from whom I had previously received repeated assurances of his zealous support. Under such circumstances, you may well imagine with what surprise I received, on the next day, a communication from the State Department, announcing that "new proposals had been received by the President," and requesting "an interview between the secretary and myself." Annexed is a copy of that communication, marked E, as also of my note declining the interview, marked F.

The President retained the decree in his possession until the last day prescribed by the constitution, and then returned it to Congress, recommending the passage of a new law, offering to any person or company the exclusive privilege granted in the decree of the 18th May, who would accept it upon the most favorable

* Not received at the Department of State with this letter.

terms; making the offer of the New Grenadian Company the maximum of concessions to be made by the government.

The decree founded upon this recommendation, together with the final decree, awarding the privilege to myself and fourteen citizens of New Grenada, are contained in the official gazette of the republic, hereunto annexed, and marked G.

It would be tedious and unnecessary to detail the various preliminary negotiations by which a union between myself and the New Grenadian Company was finally effected; but it will be satisfactory for you to know that the preponderating influence in the management of the whole concern remains in the hands of our own citizens. The principal items of the agreement are these: "*Two-thirds of the stock is the property of Charles Biddle and such citizens of the United States as he may associate with him; the remaining one-third is the property of the New Grenadians. The office of the company is to be in Philadelphia, and all instalments are to be paid there; and the number of directors is to be in the same proportion as the quantity of stock.*" During the whole discussion of this subject, both in and out of Congress, some angry feelings were necessarily engendered; but it affords me pleasure to refer you to the annexed papers, marked H, I, K, L, in order to show that perfect harmony was restored among all parties after the final action of the government had taken place.

At the period when General Bolivar held supreme command in Columbia, he manifested great zeal in obtaining accurate information relative to the most eligible mode of communication between the Atlantic and Pacific oceans. Skilful engineers and the most accurate mathematical instruments were employed, without regard to expense; and as the Liberator's influence was not confined to one State, but embraced every portion of the country through which a communication had been contemplated, the result of those examinations is entitled to great weight. The river San Juan and the lake of Nicaragua were deemed ineligible on accouut of the shallowness of the water, the numerous obstructions in the river, the violent hurricanes on the lakes, the unhealthiness of the climate, and the great distance between the two oceans—it being more than treble that of the route by the river Chagres. Doctor Pedro Gual, a gentleman of distinguished talents, and well known in the United States, was at that time Secretary of State, and took a deep interest in these investigations. A copy of his letter to me, dated the 10th of May last, is annexed, (marked M,) by which you will perceive that, in his opinion, *the opening of a canal for vessels of heavy tonnage is a chimera; and that a canal for vessels of lighter draught cannot be accomplished north of Panama.* This opinion is so universal and decisive, that the public attention has long since been altogether diverted from the consideration of a communication by the San Juan river.

The resolution of the Senate of the United States, upon which my appointment was founded, requests the President to consider the expediency of opening negotiations with the governments of other nations, and particularly with the governments of Central

America and New Grenada, for the purpose of effectually securing forever, by suitable treaty stipulations, the free and equal right of navigating any canal which may connect the Atlantic and Pacific oceans.

The Senate was no doubt influenced, in passing that resolution, by the decree of the Congress of New Grenada, in 1834, soliciting proposals from foreign capitalists to invest their funds in the projected junction of the two oceans; and it is therefore necessary to consider what was the action of the New Grenadian government upon that subject. On the 27th day of May, 1835, a law was passed granting, upon certain conditions, to Charles, Baron de Thierry, the exclusive privilege of making a *canal* to connect the waters of the Chagres and Rio Grande, and thereby to effect a water communication between the Atlantic and Pacific oceans.

The difficulty of accomplishing such a work, and its utter inefficiency when accomp ished, were so apparent to all men, whether of common or uncommon sense, that the baron deemed it necessary to address a letter to Congress, in order to remove what he termed these *vulgar prejudices*. This letter, which is quite a literary curiosity, after assigning many reasons against railroads, concludes with the following opinion, which the baron considers altogether unanswerable: "If your government proposed laying a railroad of *gold*, I would more readily conceive its feasibility than the possibility of maintaining an iron one; for the simple reason that you possess materials for the former, and that you must be entirely dependent on distant nations for the latter." The decree in favor of the baron was the result of the previous act of the New Grenadian government, inviting the proposals of foreigners to undertake the work; and, as its passage was unknown to the Senate, it may not be amiss to inquire into the character of the grantee, and the probability of his success.

Charles Thierry was born in England, and claims descent from one of the most ancient families in France, from whom he also derives his title of baron. He was one of the ushers at Cambridge University a few years since, when a number of Indians from the South sea visited England, very much in the same style and for the identical purposes which induce the red men of the north to perform their periodical journeys to Washington city. Among the curiosities exhibited for the amusement of the Indians was the interior of the college; and, whilst there, these savages, for some cause heretofore unknown, converted the "usher of Cambridge University" into "the sovereign chief of New Zealand." In order that all the ceremonies of this election should be religiously performed, a strong piece of parchment was prepared, on which pledges of fidelity were engraved without stint; and as the electors could neither read nor write, each chief, disdaining the vulgar method of placing a *cross* opposite to his name, copied, with great precision, a fair representation of the *tattooing* on his body. This instrument of sovereignty, instead of being "*signed and sealed*," according to our fashion of executing similar documents, declares upon the face of it that it has been "*tabood and doubly tabood*" in the presence of

certain witnesses, who have affixed their signatures in a fair mercantile handwriting.

The baron, like many other great men of ancient and modern times, after acquiring sovereignty over New Zealand, was disposed to extend his power; and, in order to accomplish this object, he was, on the 21st day of of June, 1835, tabood and doubly tabood "*King of Nuhaveva.*"

The last accounts received in the United States of this sovereign chief and king are contained in the English newspapers, and are as follows:

From the London Atlas, 22d May, 1836: "We have received an important paper, which we have not space now to insert. It is a memorial from the British President of New Zealand, to his fellow-subjects resident in or trading to New Zealand. Its date is the 18th of October last, and its purpose to protest against the claim of a person who styles himself 'Charles, Baron de Thierry, Sovereign Chief of New Zealand and King of Nuhaveva, one of the Marquesa islands,' to reign over New Zealand. This claim is founded, he says, on the invitation of the chiefs, whose right to invite him is derived by the British president. The adventurer has issued his manifesto, declaring that he had notified to the kings of England and France, and to the American president, his intention of assuming the sovereignty, and that he was coming with an armed vessel from Panama to make good his claim. The British president, we learn from private letters, had summoned the chiefs, who expressed ardent loyalty and independence; and, as all the British subjects would rally around the president, we may soon expect to hear that King Charles of New Zealand has met a warm reception in his intended empire."

From the London Atlas, 12th June, 1836: "The threatened expedition of the Baron de Thierry against New Zealand, which we noticed some weeks ago as in preparation, is likely to be frustrated. By a letter dated in January last, we learn that his majesty's ship Beagle had arrived at the Bay of Islands, direct from Tahita; and that her commander, Captain Fitzroy, states that he had been consulted by the queen, previous to his departure, on the propriety of permitting the baron to levy and train troops on her soil. The captain answered that such a proceeding against a friendly power would not be permitted in England, and that the queen might be made accountable for such permission to those against whom the expedition was directed. Thus the redoubtable baron's 'native battalion' was knocked up; and as the would-be King of New Zealand would learn very soon after the departure of the Beagle that the chiefs had in solemn assembly declared him a public enemy, his foreign corps would probably dismiss themselves."

The Baron de Thierry never viewed the ground through which his contemplated canal was to pass; he has no pecuniary resources to execute such a work, and is believed to be without friends. The general impression now is, that the object of his application to Congress was, indirectly, to obtain a recognition by the New Grenadian government of his right to the sovereignty over New Zea-

land. The sketch of the decree offered by him to the committee of Congress contains his *title* of sovereign chief, and he opposed with great obstinacy the proposition to expunge it. Failing in this object, he appeared indifferent whether the law passed or was rejected; and eighteen months have already elapsed without a single effort on his part to commence the work, and in six months hence his privilege expires. The law is now considered, by those members of Congress who were most instrumental in procuring its passage, as a *dead letter*; and as such, I think, it may be viewed by the rest of the world.

I have heard it said that no extensive system of internal improvement could be prosecuted in South America, on account of the difficulty of procuring laborers, and also in consequence of the instability of the governments of the new republics. These are errors proceeding from an ignorance of the true character of the people and their political institutions.

Philosophers, political economists, and other public writers, have been long engaged in disputes as to the *cause* of that natural and unconquerable indolence which they say prevails among the native inhabitants of South America. These gentlemen ought first to have established the *fact* that such a distaste for active employments and laborious occupations actually existed, before wasting their own time in such unprofitable disquisitions. I never knew a more hard working and industrious people than the natives of this country, whilst they have a prospect of reward to stimulate them to labor; but, like the inhabitants of all other countries, they are not very fond of working for amusement. Look at the miners, muleteers, and the boatmen, who are secure of receiving 25 cents per day, and it will be found that no class of workmen in the United States perform *half* the labor for *double* the pay; and one of the most striking differences between the common day-laborers of the north and the south consists in the mode of expending the fruits of their industry. The North American too frequently wastes his earnings in dissipation of some kind; whilst the South American waits patiently until his wages have reached such a sum as will enable him to purchase some trifling ornament for his mother, wife, sister, or sweetheart. The enjoyment of his leisure hours consists in thrumming upon a rudely constructed guitar, of his own manufacture, which he accompanies by those sweet Spanish love-songs which so soon reach the heart. I have said that these people were not indolent; but I do not mean to assert that *much* of their time is engaged in hard labor. I consider the charge against them to imply a deficiency of moral energy and physical power, *when properly called into action*; whereas, my experience enables me to assert that they are not deficient in either; but that their abstinence from labor arises from a combination of causes, among which are, the cheapness of living, the low price of labor, and the uncertainty of its reward.

With regard to the gloomy apprehensions, sometimes expressed, as to the instability of the southern governments, it would ill become the citizens of the United States to be the first to indulge in such forebodings. We should recollect that the politicans of Eu-

rope were engaged for the first twenty years of our national existence in deciding upon the precise hour when our proud fabric of liberty should be crumbled into dust. The southern republics are destined, like those of the north, to outlive all the calumnies of the enemies to civil and religious liberty; and it is our duty, as well as our interest, to cheer them on their march towards perfection, rather than to impede their progress by adopting the idle and injurious misrepresentations which are so industriously circulated to their prejudice.

The feverish excitements which have too frequently agitated the South American republics do not appear to originate in defective constitutions or oppressive laws, or in any glaring improprieties in the administration of the government. The great mass of the people do not complain of any grievances, but would be happy in the peaceable enjoyment of the fruits of the soil, which are here obtained in greater abundance, for a smaller modicum of labor, than in any other part of the world. There is no land tax in New Grenada, and the revenue of the State is derived from monopolies of salt and tobacco, the duties upon the importations of foreign merchandise, licenses to merchants, and other indirect modes of taxation, which are not very sensibly felt by the people at large.

The various revolutions through which these republics have passed within the last thirty years have contributed to raise up such a host of *chiefs*, that the country does not furnish a theatre sufficiently extensive to gratify the ambition and cupidity of them all. Many of these persons have, during a course of thirty years in the military service, been found arrayed, by turns, as the champions for every form of government, either advocated, rejected, or adopted, within that period.

This is a fruitful source of recrimination among the different leaders of the present day, and their friends; and the vocabulary of South America does not yield to that of our own in the abundance of its offensive party names and political distinction.

The military men of the country, being thus divided among themselves, have, within a few years, had to encounter a party, highly respectable in itself, and which is constantly gaining additional strength. This party consists of those persons who were too young in the early stages of the revolution to take an active part in the affairs of the country, many of whom were sent to Europe and the United States to receive their education. They have returned to their native country, and are rapidly acquiring political influence, which is, upon all occasions, exerted in the republic of New Grenada for the maintenance of order and good government.

As an exclusive grant for the only practicable mode of communication between the two oceans is now vested in citizens of the United States, it appears to me unnecessary, at present, to enter into any negotiations with foreign nations upon the subject.

I have the honor to be your obedient servant,

CHARLES BIDDLE.

To the Hon. JOHN FORSYTH,
Secretary of State.

B.

[Translation.]

PANAMA, *December* 4, 1835.

SIR: The enlightened government of the United States of North America has confided to you an affair of the utmost importance for our country, in authorizing you to determine which of the various points spoken of, for some time past, as affording a means of communication between the Atlantic and Pacific oceans, should be preferred; and as your final determination will doubtless be the result of long calculations, and careful comparisons and examinations of every thing already written on the subject, we consider it proper to submit to you some documents connected with the question, which we hope will serve to contribute to clear the way for the great enterprise placed under your direction, or will at least facilitate the performance of the arduous labors required for the solution of this important question.

From the moment when the isthmus of Panama declared itself independent of the Spanish crown, it became aware of the necessity of attracting, by means of a free communication between the two oceans, the commerce of Europe and of the United States with the republics bordering upon the Pacific; being persuaded that mercantile voyages would cease to be made around Cape Horn as soon as the physical inconveniences which now obstruct the passage across the isthmus should have been removed, and transportation of articles, and of the productions of the country, could be effected with despatch and economy.

It soon after observed that such a communication would not only afford the advantages above mentioned, but that, as its own capital, Panama, would necessarily be the place of deposite of the productions of Asia and of the adjoining fifth great division of the world, as well as of the other three, it would become the great exchange of all the merchants of the earth, from the moment when the hand of industry should have annihilated the slight distance between the two waters.

It was for some time believed that the great object which we propose would be fulfilled by a railroad; and our government, in consequence, invited the capitalists of all civilized nations to undertake the enterprise. (See document No. 1.) More recently, however, the Baron de Thierry has maintained that a ship canal would be preferable, and that it might easily be accomplished by uniting the waters of the river Chagres with those of the river Grande, which are very near each other. Relying upon the protection of some London bankers, he solicited an exclusive privilege, which was granted to him by the last legislature, upon the terms which you will see expressed in document No. 2. Document No. 3, which we also send, contains a note from the said

baron, containing the principal reasons which induced him to prefer a canal. You can copy this note, if you think proper, and then return to us the original. We think that it would also be of use to send document No. 4, containing the statement which two of the undersigned, together with Señor Pedro Obarrio, addressed to the governor, Sr. Juan Jose Argot, in reply to the note addressed to us by him on the 17th of May, 1833. It proves that we possess all that is necessary for the important work in contemplation. Finally, we are happy to be able to inform you that in the parish of Cruces is a laborer, named Marquines, who, for the small sum of one hundred dollars allowed to him by the municpal council of this place in 1834, has opened a path from Cruces to Port Bello; by which the heights in the line of road discovered by the late Domingo Lopez have been avoided, as well as the necessity of crossing the different rivulets which embarrass the old road hitherto in use.

We shall say nothing to you respecting the road traced by the engineers Falmarck and Lloyd, because it is to be supposed, or rather it is certain, that you have the report published by the latter in English, and since translated into French.

Before concluding this note, we will make particular mention of the famous law of May 25, 1835, granting free trade to the cantons of Panama and Porto Bello as soon as a railroad or ship canal shall have been opened across the isthmus. This law, which will be found in document No. 5, has been brought about by constant and urgent efforts for fourteen years, and particularly by the exertions of the newspapers of this place, in proving the advantages of free trade to our country, for the purpose of inducing capitalists of all parties to undertake the opening of the desired communication between the two seas. New Grenada, by issuing that said law, has laid the foundations of our future happiness, and has given the strongest guaranty to those who may venture in the great enterprise now engaging our attention. If the trade of the isthmus were to remain subject to the fiscal obstacles common in all other parts of the republic, and to the exaction of duties as now enforced, we should never succeed in realizing the expectations of advancement which we have entertained in consideration of our precious and singular topographical situation. The absolute freedom of trade required by this decree is, indeed, the first element of the prosperity of the isthmus, as well as of those generous persons who may engage in forwarding the execution of the sublime idea of bringing, as we may say, in contact, the most distant points of the globe, as respects their commercial intercourse.

Being anxious that you should employ us with entire confidence in this affair, so far as our assistance may be in any way useful to you, we have taken the liberty to begin this correspondence, with the firm persuasion that the happiness of the isthmus depends exclusively upon the projected communication either by land or by water, and that we should all contribute, to the best of our means, to the great work of our mercantile regeneration.

Be pleased, sir, to accept, on our part, the expressions of true

esteem with which we have the pleasure to be your most obedient servants,

BLAS AROSSEMENA,
MARIANO AROSSEMENA,
JOSE DE OBALDIA.

To Colonel CHARLES BIDDLE,
Commissioned by the government of the United States of North America.

No. 1.

Decree authorizing the executive of New Grenada to contract, under certain conditions, for the opening a carriage road across the isthmus of Panama.

[Translation.]

The Senate and House of Representatives of the State of New Grenada in Congress assembled, considering—

1. That the message addressed by the executive to Congress, on the 6th of April, 1833, especially sets forth the urgent necessity of promoting the opening of a carriage road across the isthmus of Panama, from the Atlantic to the Pacific.

2. That the Chamber of the District of Panama took up this interesting subject on the 16th of June, 1831, and that its wishes have not yet been carried into fulfilment:

3. That the same project has been again taken into consideration by the Provincial Chamber of Panama, at its meeting of October 13, 1833, on the petition of a citizen of the isthmus, who proposed some measures for opening a carriage road by which goods might be carried with facility from one sea to the other: Do decree—

ARTICLE 1. The executive is authorized to receive all propositions which may be made on the subject of opening a road in the isthmus of Panama, and to conclude a contract with any individual or company soliciting it, agreeably to the rules fixed in the present decree.

ART. 2. The contractors (*empresarios*) shall be allowed to open a carriage road or railroad, crossing the isthmus of Panama, from the Atlantic to the Pacific; and they may avail themselves of any canal, for the purpose of forming a part of the said communication.

ART. 3. The road shall be commenced within two years, at the farthest, from the period at which the privilege or charter is granted; and the time at which it shall be completed is to be stipulated in the said charter.

ART. 4. If the line of the road should pass through lands belonging to individuals, the owners shall be obliged to sell them at a fair price, such as may be determined by arbitrators when the work is to be commenced. If the lands through which the road is to pass be vacant, they shall be given without indemnification.

Art. 5. The contractors shall be allowed to erect, at convenient places, such warehouses and other buildings as may be necessary for the purposes of the enterprise: provided, however, in all cases, that they do not infringe the laws concerning fortifications. For such purposes they may occupy as much land as may be necessary, not exceeding 10,000 square varas; for which they are to indemnify the owners, by purchase, according to the provisions of the 4th article, or by payment of rent, in case those owners should be unwilling to sell their property.

Art. 6. The contractors shall have allowed to them, as a fair remuneration, according to the character of the road which they may undertake to open, the enjoyment of the receipts from it during a period of not less than ten years, nor more than fifty.

(1.) The right to demand toll or passage money shall commence so soon as the road has been completed; and the *maximum* of such toll or passage money shall be that expressed in the tariff allowed by the Provincial Chamber of Panama, which is to be considered as forming part of this decree.

(2.) If the road to be made be a railroad, with iron rails, the contractors may be allowed to place coaches and wagons propelled by steam, during the same period; in which case, the *maximum* price of transportation of persons or goods from one sea to the other shall be fixed in the contractors' charter.

Art. 7. The contractors shall be allowed, as a remuneration, vacant lands in the isthmus, to the extent of twenty thousand *fanegadas* for cultivation, which they must begin to cultivate or to settle within a year after receiving them; otherwise, the said lands shall revert to the nation.

Art. 8. Foreigners may be established as settlers on the said twenty thousand *fanegadas*, who shall be exempt from taxes on their lands or its productions for twenty years, and from serving in the army, except in case of foreign invasion.

Art. 9. Inhabitants of the isthmus of Panama, or companies composed in part of such inhabitants, shall have the preference, under similar circumstances, in receiving the contract.

Art. 10. The executive shall require from the contractors every security requisite to insure the completion of the work.

Art. 11. No contract which the executive may make can be executed until it receive the approval of the legislature.

Given at Bogota on the 22d of May, 1834.

VICENTE BORRERO,
President of the Senate.
JUAN CLIMACO ORDONEZ,
President of the House of Representatives.
JOSE V. MARTINEZ,
Secretary of the Senate.
RAFAEL M. VASQUEZ,
Deputy Secretary of the House of Representatives.

Bogota, *May* 25, 1834.

Let it be executed and published.
FRANCISCO DE PAULA SANTANDER.
By his excellency the president of the republic:
LINO DE POMBO,
Secretary of the Interior and Foreign Relations.

Decree for the execution of the foregoing.

Francisco de Pauda, Santander, *President of the Republic.*

In execution of the legislative decree of the 25th instant, authorizing the executive of the republic to receive proposals with respect to the opening of a carriage road in the isthmus of Panama, from the Atlantic to the Pacific, and fixing certain conditions as the basis of a contract and charter to be concluded with those who may wish to engage in this important enterprise; considering that it is proper to determine a period of time, within which proposals may be received, and after which a contract is to be made with, and a charter granted to, the persons offering the most advantageous terms and the best securities, I do hereby decree—

Art. 1. Those persons, whether natives of New Grenada or foreigners, who may desire, in virtue of the legislative decree of the 25th instant, to undertake the construction of a road from the Atlantic to the Pacific, in the isthmus of Panama, either for ordinary carriages or a railroad, and to secure to themselves the privileges which are to be the remuneration of their labors and expenses, will address their propositions, enclosed under seal, to the department of the interior and foreign relations, before the 15th of January, 1835.

Art. 2. Persons thus sending proposals should appoint some one in this capital as their agent, giving him instructions and powers sufficient for concluding the contract to be made, and for satisfying the government that they have the means of accomplishing the work, in case the privilege should be granted to them.

Art. 3. In the envelope of each set of proposals shall be a separate memorandum, showing the name or names and the objects of the persons who wish to contract for the work.

Art. 4. After the 13th of January, 1835, a day and hour will be fixed for the opening of all the papers containing the proposals, at the department of the interior and foreign relations, in presence of the respective agents; and a contract will then be made with the person offering the most advantageous terms and the strongest securities. Such contract will be submitted to the Congress for its approval at its ensuing session.

Given at Bogota, May 27, 1834.
FRANCISCO DE PAULA SANTANDER.
By his excellency, the president of the republic:
LINO DE POMBO.
Secretary of the Interior and Foreign Relations.

No. 2.

Decree granting the privilege of opening a ship canal across the isthmus of Panama.

[Translation.]

The Senate and House of Representatives of New Grenada in Congress assembled, having examined the propositions made by Charles, Baron de Thierry, for opening a canal across the isthmus of Panama, uniting the two oceans; and considering—

(1.) That this undertaking is of great national importance, inasmuch as it will facilitate commercial operations, and will attract to the isthmus the business of Europe, America, and Asia, which is now carried on by way of Cape Horn and the Cape of Good Hope:

(2.) That no proposition has been made for a carriage road in that part of the republic, notwithstanding circulars were issued by the executive, in virtue of the authorization received from Congress to conclude a contract to that effect, according to the conditions fixed in the legislative decree of May 25, 1834, do hereby decree:

Article 1. Privilege is granted to the Baron de Thierry to open a canal, by the aid of the waters of the rivers Grande and Chagres, and the bay of Limon, adopting such positions as he may consider the most advantageous for the secure passage of vessels not drawing more than ten feet water, and of the cargoes passing from one ocean to the other; such territories belonging to New Grenada as he may need for the establishment of moles, wharves, and other works, indispensable to the canal, being also allowed to him.

Art. 2. After the said canal shall have been opened, the Baron de Thierry is to enjoy the exclusive right of navigating it, in vessels moved by steam, or by any other mechanical or animal power; of towing vessels of all sorts through it, and of levying tolls upon the passage of vessels and cargoes along it, according to the tariff forming part of this law.

§ 1. A fine of five dollars per ton is to be established in favor of the Baron de Thierry, upon every ton measure of vessels of all denominations passing through the canal, without paying the duties fixed in the said tariff; and such vessels shall be detained until the fine be paid.

§ 2. This privilege is not to prevent canoes, or boats without decks, belonging to individuals residing in the province of Panama, from passing along the canal, provided they do not carry passengers from places out of the isthmus, nor goods intended for exportation; in all cases, however, in which such small boats may injure the service of the canal, they cannot insist on passing through the locks and sluices.

Art. 3. During the period for which Baron de Thierry possesses the privilege of navigating the canal, the government of New Grenada will exact no duties on foreign goods passing through it, to be consumed in other countries.

ART. 4. All goods or articles destined for the use of the canal, and of the works indispensable for its service, shall enter the isthmus free from duties of any sort.

ART. 5. The republic engages not to grant permission to any nation, company, or individual, to open across the isthmus of Panama a canal other than that to which this decree relates, nor any other communication by water between the two oceans, within twenty marine leagues of either bank of the canal which may be opened by the Baron de Thierry; nor can any privilege be conceded to New Grenada for a railroad from one sea to the other within one league to the right or left of the canal, until after the expiration of two years from the date of its being opened.

ART. 6. The passage of letters by the canal of the isthmus shall not be subjected to the post office regulations of New Grenada, nor to the payment of postage designated for them, in all cases in which the letters are addressed from one foreign country to another, and have not been landed in any part of the Grenadian territory.

ART. 7. The authorities of the isthmus shall not have the right to require passports from travellers passing from one sea to the other by the canal; the political authorities shall merely take account of the names of the passengers, and the places of their residence and destination.

ART. 8. The Baron de Thierry, in return for the privileges conceded to him by this decree, remains under obligation—

(1.) To deepen and widen the rivers Chagres and Grande, and to excavate the earth so as to give passage to the waters uniting those streams, so that the navigation of the canal between the two oceans may be performed with convenience.

(2.) To build moles or wharves, stores, locks, dams, bridges, and all other works indispensable for carrying into effect the free communication between the two seas.

(3.) To keep the canal in good condition, as well as all the works connected with it, so long as he retains the privilege.

(4.) To give up the canal to the republic at the end of fifty years from its completion, in good condition, as well as the locks, dams, and bridges pertaining to it, excepting the vessels and boats of all sorts, the stores, fortifications, and artillery.

(5.) To begin the work within two years from the date of this privilege, and to complete it within three years after its commencement.

(6.) To pay to New Grenada one per cent. of the whole produce of the canal from freights, fees for towing, passage money, tolls, and every other branch of its revenue; the Executive being charged with devising measures and adopting precautions for the proper collection of such per centage.

ART. 9. The Baron de Thierry is to support the expenses of erecting such fortifications, and of providing them with artillery, as the Executive may judge requisite for the defence and protection of the canal; he is also to cover the expenses of the garrisons

of such fortifications, which are always to be composed of Grenadian troops.

Art. 10. By failing to comply with any of the conditions stipulated in articles 8 and 9, the baron will, *ipso facto*, forfeit the privilege.

Art. 11. The vessels and citizens of all countries which may be at war with New Grenada are prohibited from using the canal.

Given at Bogota, May 27, 1835.

JOSE CORNELIO VALENCIA,
President of the Senate.
FRANCISCO DE P. TORRES,
Secretary of the Senate.
EZEQUIEL ROJAS,
President of the House of Representatives.
RAFAEL M. VASQUEZ.
Deputy Secretary of the House of Representatives.

Bogota, *May* 29, 1835.

Let it be executed and published:
FRANCISCO DE PAULA SANTANDER.

By his excellency the President:
LINO DE POMBO,
Secretary of the Interior and Foreign Relations.

Tariff of prices of transportation across the isthmus of Panama, referred to in the 2d article of the foregoing decree. The sums here stated are the highest which can be demanded.

For every ton in measure of a vessel in ballast, according to her register, including the price of towing, by steam or other mechanical power, not to exceed twenty reals.

For every ton in measurement of a vessel laden wholly or in part according to her register, including the price of towing, not to exceed forty reals.

For every passenger in such vessels, or in steamboats crossing by the canal, not to exceed thirty-two reals.

For every ton of heavy goods transported by boats from one end of the canal to the other, not to exceed a hundred reals.

For every package, equal in size to a barrel of flour, weighing eight arrobas, not to exceeed twelve reals.

Articles of merchandise of greater or less dimensions, either in bales, barrels, pipes, or other covering or vessel, to pay in the same proportion.

The troops of the republic which may cross by the canal in vessels belonging to the contractor, are to pay for their passage, namely, eight reals for each chief or other officer, and four reals for each inferior or common soldier.

For the transportation of cattle, horses, and mules, not more

than thirty-two reals per head; of swine, not more than sixteen reals; and of sheep and goats, not more than eight reals each.

FRANCISCO DE PAULA TORRES,
Secretary of the Senate.
RAFAEL M. VASQUEZ,
Deputy Secretary of the House of Representatives.

No. 3.

Note from A. Vigneti, secretary of the Baron de Thierry, to the Society of the Amigos del Pais (Friends of their Country) of Panama.

[Translation.]

PANAMA, ISTHMUS OF DARIEN,
Jonuary 8, 1835.

GENTLEMEN: I address you in the name of the Baron de Thierry, in compliance with the wishes manifested by you to learn his views on the subject of the advantages to be respectively derived from a canal or a railroad uniting the Pacific and the Atlantic oceans. It would be a work of great difficulty to obtain complete details on the subject of this grand and interesting project; and as the baron has explained his ideas in his conferences with you, it will be sufficient for me to present together the reasons by which he succeeded in convincing you of the vast necessity of navigation by a ship canal across the isthmus. This I shall do, showing in a compendious manner the principal circumstances to be considered, and leaving it to your own wisdom and patriotic zeal for the welfare of all classes of your fellow-citizens, to submit to the Congress of the nation the plans for realizing these views, which, if executed, would indisputably render this country the seat of a commerce so exrensive as to raise it soon to the zenith of prosperity.

It is evident, gentlemen, that whatever may have been the views of those who have conceived future benefits from a railroad, and whatever may have been the reasons which have induced the government to solicit propositions on that subject, the plan of a railroad has been preferred without due consideration of the means by which it may be executed. In saying this, do not understand me as alluding merely to the expenses of such an undertaking, but to the difficulties offered by the nature of the ground on which the work is to be executed; and those difficulties would cause the expense of the work to be doubled.

In the first place, it must be recollected that a road across the isthmus of Darien could not be executed with as much facility as in other countries presenting the same general appearance. On examining the soil, we find not only those natural obstacles which might be overcome by perseverance, but also that the hand of Time has likewise placed many other inconveniences in the way, which

cannot be overcome without removing what has so long opposed the designs of the people of the isthmus. The Baron de Thierry determined to judge for himself respecting the possibility of effecting a passage across the isthmus in a short time; he landed at Chagres; and having ascended the river Chagres up to Gorgona, and examined carefully the character of the soil, he was convinced of the disadvantages of a railroad, not only from the circumstance that the ground is very uneven, but because the primitive surface has been, in the course of ages, covered to the depth of many feet with dead leaves and other vegetable remains; these have, from unknown causes, been decomposed; and have thus been converted into a spongy mass, which must be entirely removed, in order to obtain a solid and stable foundation. You, gentlemen, well know that, of all works invented by the ingenuity of man, none require bases so firm as railroads; and as the existing superficial soil varies in thickness from four to fifteen and sixteen feet, it would be absolutely necessary to remove these decomposed matters, in order to obtain a proper foundation; and this would prove an insuperable obstacle to the establishment of a railroad. The easiest way would be to rest the beams upon piles, wherever the ground would allow it; which would seldom however be the case, as in many places the deposite soil lies in great thickness upon beds of rock, into which the piles would not penetrate; therefore the road would have no solidity, and it would be impossible to keep it constantly level.

In the second place, we will examine other inconveniences interposed by nature against the execution of a railroad. From the chain of mountains traversing these regions, proceed a thousand little rivulets, increasing the great rivers, which are themselves partially absorbed in their turn by an infinite number of streams during the rainy season. As the mountain streams bring down great quantities of wood into the valleys, and continue running the whole of the winter, the roads will be obstructed at that time, and the expense of keeping them clear will be ruinous to the enterprise; while the roads themselves will be injured in many places by the impetuosity of the torrents washing down from the mountains.

In the third place, independently of the preceding objections, is another circumstance, sufficient of itself to present a very great obstacle to the establishment of a railroad across the isthmus, namely, the thickness of the woods covering the ground. These it would be necessary to clear away for some distance on each side of the road, in order to avoid the embarrassments which they would otherwise occasion; and this would double the expense of the work.

In the fourth place, admitting the advantages of a railroad over a ship canal to be of sufficient weight to determine the adoption of the former, notwithstanding the impediments against its execution, I still request you, gentlemen, to take into consideration some circumstances which will prove that it would be at least more prudent to embrace the latter mode of communication, as being more conformable with the provisions of nature and with the independence

of the enterprise. The Baron de Thierry observed to you, gentlemen, that if the Grenadian government had proposed to establish a railroad of gold, it might have been considered more practicable than one of iron; for the simple reason, that the country possesses materials for the former, and that it would be absolutely dependent on foreign nations for those of the latter. Even the United States, notwithsanding their extensive resources, their numerous iron works, and a considerable commercial marine for the protection of the operations of that republic, have found it more convenient to procure the iron from Europe than to use that obtained from their own mines. Foreign iron is much used by them; *but they could, if they pleased, give up the use of that from Europe.* But is New Grenada in the same situation? No. Does she possess the materials for a railroad of iron? Can the cannon required for the walls of this fortress be obtained, without bringing them from abroad? And even if there were among the mineral treasures of this country vast mines of iron, could they be worked under the actual circumstances of its amount of population and of resources? The purchase of foreign iron is a contingency; and as the possibility of buying it is not a certainty, we consequently cannot depend upon such a mode of supply. Can the government give assurance that it will *never* be engaged in war with other nations, even with those in its immediate vicinity, which might thus, by their maritime forces, prevent the obtention of these supplies? But supposing the railroad to be completed, and that we possess the iron requisite for repairing it during the ensuing twenty years; can we have any assurance that after that period we can obtain iron from abroad? The want of a single rail or bar of trifling value may render useless a railroad which has cost millions! The communications will be at all times liable to be interrupted by any ill-intentioned person, and the interests of civilized nations may be injured by the action of a single immoral individual, in removing some rails during the night, and thus stopping the communication between the two oceans. Moreover, where are the saw mills for cutting out the wood? And without them, how much time must be lost in cutting, sawing, and otherwise preparing a sufficient quantity for a railroad from Panama to the northern coast? Models may be obtained from the United States; but that country may refuse such assistance, from the same reason for which Great Britain might refuse to send its iron—simply that the passage across the isthmus would diminish its political importance in proportion as it would enrich the west, at the expense of the north and south. Will Brazil, Buenos Ayres, and the Cape of Good Hope, be indifferent, when they lose the hundreds of vessels which now visit their ports on voyages around the capes? South America and Africa will cease to hold the entire control of the passages to the west when the isthmus of Darien shall offer a more expeditious mode of communication to the merchants of Europe. This new era will produce a complete revolution in the mercantile world; it will then be seen how imperiously necessary it was for New Grenada to adopt a mode of communication which would render her inde-

pendent of foreign supplies. If the republic should determine on the construction of a railroad, it cannot be independent; and all the national feeling of the country should be exerted in order to influence the selection of the plan, in the execution of which it can employ its own resources and its own labor, which may be protected by its own forces and care, and which, though aided by foreign capital, may yet be completed and maintained by its own citizens. A railroad will always belong to others, whilst a canal must be permanently the property of the nation. Nature has enriched the country with tributary streams, which supply its rivers; she has already opened a passage across the greater part of the isthmus; the chain of mountains, which might have completely frustrated your views, here sinks, and is cut by valleys offering the means of communication between the seas. And when thus favored by the hand of the Creator, are the uncertainties of art to be preferred to the certainties of nature? It is assuredly much better to unite the favorers of both opinions in the prosecution of one grand object, in forwarding the execution of a magnificent work, which shall raise this spot to the highest place among the greatest and richest countries of the new world. The day approaches when the mouldering buildings of this city shall be filled with the most valuable productions of Europe; when the grain of the fields of the isthmus shall find a ready market in the regions of the west; when the cattle, the hides, the coffee, the indigo, the cotton—in a word, all that can be produced and manufactured in this country, shall find an outlet; when its ports shall be alive with ships and steamboats engaged in active coasting trade; commerce will rapidly increase, cities will flourish, rents will be raised, comforts and felicity will render cheerful the poor—not for a limited period only, and in obedience to the will of other nations, (as would be the case if the railroad plan were adopted,) but so long as public spirit may keep up the canal.

Gentlemen, having expressed all that I thought calculated to incline you towards the undertaking which favors the subject of this note, I shall conclude with a few lines respecting the present and future condition of New Zealand, in order to enable you to reply to every observation which may be made in the National Congress. New Zealand has been hitherto governed by its native chiefs or kings; and from them the Baron de Thierry, fifteen years ago, received various rights of supremacy, in virtue of which he has since been a sovereign chief. A profound feeling of friendship existing between him and the powerful chiefs of New Zealand who visited England, induced him to yield to their repeated instances, and to engage to go to that country and govern it as principal chief, in order to secure for it the blessings of civilization and prosperity. The Baron de Thierry is, accordingly, on his way to preside over the destinies of New Zealand, and many persons of distinction have, like myself, left their employment in other governments to consecrate their fortunes to the service of those inhabitants. To him we owe obedience in future; and we, as well as those who are

now on their way, unite in declaring that we will do all in our power to second his efforts for the improvement of the human race, and for the honor and prosperity of our adopted country. New Zealand has been declared independent by an act of parliament, and by the British ministry in 1823; *and is and will remain independent, free, and neutral*, equally accessible to all men and to all flags of the earth; it invites emigration, protects commerce, favors agriculture, and is ready to exchange its rich productions for the manufactures and productions of other nations. The geographical situation of this important country renders necessary the opening of a more easy channel of communication with Europe and the United States: the isthmus offers such an advantage; and the Baron de Thierry, accompanied by a numerous and young family, has faced all the dangers and expenses of the sea, in order to assure himself personally of the possibility of a communication; and, having satisfied himself on this point, he addresses his propositions to the Congress of Bogota, authorizing me, gentlemen, to have the honor of submitting to you the transcendent reasons for confining your views to a ship canal, instead of seconding the projects for a railroad.

I am, gentlemen, with sentiments of the highest consideration, your most obedient, humble servant,

A. VIGNETI.

To Hon. Mariano Arossemena,
Jose de Obaldia, and
Blas Arossemena,
Deputies to the Congress of Bogota, &c.

No. 4.

[Translation.]

STATEMENT.

Colombia, State of New Grenada,
Panama, August 31, 1833.

Sir: Your communication of the 17th of May last, numbered 1,048, gives us the utmost pleasure, as it places in our hands an affair the most interesting for our country, namely, the opening of a railroad across the isthmus; with which view you also send us various questions proposed by M. de Vilvak, the inventor of a new plan for railroads.

The difficulties of obtaining information on several of the points thus submitted to us, together with absence for some days, and sickness which ensued, have prevented us from giving you the answers as soon as you could have desired. We however send them to you annexed; and you will see, sir, that we have neglected no means of obtaining light upon the points submitted to us. May this short communication produce the advantages which you and

all other good citizens of the isthmus expect from the free communication between the two oceans!

We ardently agree with you, sir, in the desire expressed by you that the province of Cauca be invited to take an active part in this enterprise; and as General Thomas Cipriano Mosqueza, who has had the kindness to present the said documents to the government, is in that province, his co-operation, together with the interest which the inhabitants have in the attainment of this great object, will doubtless influence them powerfully in aid of its completion, agreeably to our hopes.

Being well persuaded that the carriage-road should run from Porto Bello to this city, directly, we have preferred this route to every other, notwithstanding the opinions submitted by Mr. Lloyd to the Royal Society of London.

Be pleased, sir, to receive herewith the assurances of respect of your most obedient servants,

MARIANO AROSSEMENA,
PEDRO OBARRIO,
JOSE OBALDIA.

To the GOVERNOR *of the province.*

[Enclosed in the preceding.]

There are six points upon which M. Vilvak requires detailed information, in order that he may form an estimate of the expenses of the carriage road between the Atlantic and Pacific; which communication, in our opinion, should be formed between Porto Bello and Panama, leaving aside the route proposed by the English engineer, Mr. Lloyd, from the bay of Limon to this city; for the reasons that the distance between the ports first named is less than that between the others; that Porto Bello is a safer and more quiet harbor, and has already convenient buildings; and that the ground is better for the work.

Agreeably to M. Vilvak's plan of curves, in order to avoid the ordinary difficulties in the construction of railroads where their track is crossed by heights, the eminences on this route offer no insuperable obstacles; and thus, the only objection which could be raised against the line proposed by us vanishes.

Considering, then, all the questions propounded by M. de Vilvak in order, we shall now answer each of them in detail.

1. The ordinary price of bricks, one *tercia* in length, half a *tercia* in breadth, and two *pulgadas* in thickness, is fifteen dollars a thousand. Master masons and carpenters receive for their work, when employed in the city, ten reals a day; and when employed out of it, they require the usual food in addition. Blacksmiths (of whom there are very few) never work by the day or other fixed time, but receive the price agreed on for their work. Laborers are paid, at the utmost, three reals a day; their employer furnishing them with food, but no liquors of any sort. As the price of

draught horses and oxen does not exceed sixteen dollars a head, and there are great numbers of them in every part of the isthmus, we consider that it would be much more advantageous to buy them than to hire them at two or three reals a day. Mules are scarce with us, and they are generally worth from thirty to forty dollars each.

2. The number of tons now transported across the isthmus could not serve as a basis of calculation for those who should undertake the road, inasmuch as the difficulties, obstacles, and costs of transportation, at present prevent the passage of general trade, which is now carried on by way of Cape Horn.

3. The distances between the two most notable points on the route, in the most direct line, are—from the city of Panama to the house called Cangrejo, two and a half miles; and thence to another house called Mataredouda, three miles; from that place to the source of the Cardenas, about a mile and a half, and there is but little water in the stream; from the source of the Cardenas to the mountain called the Peñon, two miles and a half; and from that place to the Chilibre, two and a quarter. The last named rivulet joins the Chilibrillo, and both empty into the Cruces, opposite the deep ravine near the Huacas. From the Chilibre to the entrance of the Chilibrillo, two miles; and thence to the river Chagres, a long mile and a half. The Chagres is a plentiful stream, navigable for small vessels from it to the Gatuncillo, five miles and a half. From that rivulet to the ravine of Sardinilla, on the side of the mountain Algarrobo, is a distance of a mile and a half. The whole of the ground from Panama to this place is hard and level, except at the Peñon, and another mountain between the Chilibrillo and the Chagres; neither of which, however, is high. The Algarrobo is the beginning of a chain of mountains which ends at Porto Bello, and is, moreover, the highest of the whole chain. From Sardinilla to the Gatun river, on the northern side of the Algarrobo, the distance is about three and a half miles, in a straight line; from the Gatun to the Aguilucho mountain, the second in height of the chain, is three and a half miles; thence to the river Grande, which empties into the sea at Naranjo, the distance is about two and a half miles. From the Grande to a torrent at the foot of the rough mountain of Iguana, two and a half miles; and thence to the head of the Jopeana river, two miles. From that little river to another torrent in the north side of the mountain, the distance, by measurement, is three miles and a half; and from that torrent to the summit of the Trinchera, a mile and a half. In this latter distance, in which the ground is nearly horizontal, there is a torrent falling into the northern sea. From the point last mentioned, to two wells near Porto Bello, descending the Trinchera mountain, is a mile and a half direct. Thus the distance from the shore of the Pacific to that of the Atlantic is forty-two miles and a half, or, what is the same thing, fourteen long leagues.

It must be observed that this account of the distances is taken from the notes of Señor Domingo Lopez, who was charged to open

a path across the isthmus in 1826, at the expense of the municipality.

4. The value of the articles now sent across the isthmus may be considered as averaging about fifty or sixty dollars per ton. They are carried in boats from the mouth of the Chagres, up that river to Cruces, a distance of eighteen leagues; and from Cruces to Panama, seven leagues, on mules and horses, by a narrow and bad road. As we have said before, in No. 2, the men and animals thus employed are very few in number.

5. Materials for masonry, such as clay, stone, lime, and sand, are to be found in abundance on the way from this city to Porto Bello.

6. The Colombian league, here adopted in indicating the distances, is equal to six thousand *varas;* each *vara* is of three feet, and each foot of twelve *pulgadas* or inches. The mile is a third of the league. The ton contains twenty quintals, each of a hundred Castilian pounds. The *fanega* of land is equivalent to twelve hundred square *varas.**

Having thus answered the interrogatories of M. de Vilvak, we should not omit to explain some circumstances noticed in the letter from that engineer to M. de Vasigne.* The value of the ground which the road would occupy is not taken into consideration, because it is not the custom in our country to sell land destined or applied to such purposes of common interest; the price of the public land in the maritime provinces is two dollars the *fanega*; and in the central provinces one dollar. The duty on iron imported, according to our tariff, is one dollar per quintal; but as instruments of agriculture have been declared free from duty, for the advantage of the country, we conceive that, upon the same principle, all the iron which may be imported for the railroad will be declared free from import duties, and from all municipal charges.

We cannot conclude this statement without declaring our entire acquiescence in the judicious opinions of M. de Vilvak. Certainly the profits of the railroad for the first year after its completion will not be very great; but in the ensuing years, the contractors, the isthmus, and all mercantile nations, will receive advantages from it which are now incalculable.

If these statements should be insufficient to convey an exact idea of this important affair, or M. de Vilvak should require, in order to form his estimates, other information which we may be able to afford, we shall be happy if the government will add to the proofs of its confidence which it has already given to us, by asking us again to procure such information; and General Mosqueza, M. de Vasigne, M. de Vilvak, and any other person interested in this great work, may rely upon our decided co-operation, as well as on that of every patriotic inhabitant of the isthmus.

MARIANO AROSSEMENA,
PEDRO OBARRIO,
JOSE OBALDIA.

PANAMA, *August* 31, 1833.

*This is an error; the *fanega* contains ten thousand square *varas*.

No. 5.

Decree declaring the cantons of Panama and Porto Bello, in the isthmus of Panama, open to the commerce of all nations for twenty years.

[Translation.]

The Senate and House of Representatives of New Grenada in Congress assembled, having examined the representations addressed, on various occasions, to the Congress of Colombia, by the inhabitants of Panama and Porto Bello, soliciting the concession of free trade to those countries, and considering—

1. That the isthmus of Panama, by its geographical position, is capable of maintaining an extensive commerce with all the nations of the earth:

2. That, if the attainment of such public prosperity has been delayed by any obstacles, it is the duty of New Grenada to remove them, by a law which may secure these blessings to the nation: do decree—

Article 1. The cantons of Porto Bello and Panama, in the province of Panama, are declared open to the commerce of all nations, not enemies of New Grenada, during the space of twenty years: no species of merchandise is prohibited in them. The seventh article of the law of July 19, 1821, respecting the manumission of slaves and the abolition of the slave trade, remains, however, in full force and vigor.

Art. 2. National and foreign merchant vessels may remain for any length of time in the ports of the two cantons above named, without being molested, under any pretext, by the fiscal agents of the government, either at their entrance or departure, or during their stay.

Art. 3. No duties of anchorage, tonnage, importation, exportation, *alcabala*, deposite, or of any other nature established by the commercial laws, shall be exacted within the said cantons.

Art. 4. There shall be no monopoly of tobacco or of brandy in the cantons of Panama and Porto Bello, nor shall any contribution be exacted upon the distillation and sale of brandies.

Art. 5. The custom houses of Panama, Porto Bello and Chagres are suppressed.

Art. 6. A custom-house shall be established in the port of Chorrera, the business of which will be conducted by officers designated in a special decree.

Art. 7. All merchandise and fruits destined for consumption in the cantons of Chorrera, Natá los Santos, and Darien, are to be entered at the custom-house of Chorrera; and on them are to be paid the duties required in other parts of New Grenada.

Art. 8. The foreign merchandise and produce found, without having acquitted the duties on them, in any part of the cantons of Darien, Natá los Santos, and Chorrera, shall be confiscated; their importers being, moreover, subjected to the penalties decreed against smugglers.

Art. 9. By a special resolution, which will be passed at a pro-

per time, a place will be designated to which shall be transferred the principal administration of tobacco, now established at Panama; and all the subordinate offices of this branch of the revenue in the other cantons, not enjoying the exemptions granted by this law, shall remain subjected to the said principal administration.

Art. 10. Those who desire to sell foreign goods or productions in the cantons of Panama and Porto Bello must take out a patent, to be delivered by the administrator of the respective branch of the revenue; and those who contravene this disposition will be subject to a fine of four times the cost of the patent.

It shall be stated in the patent that it is granted for the establishment of a store or shop, that the patentee is to pay twenty dollars per month for a store, and five dollars per month for a shop; and that the patent is to be re-formed, according to the classification adopted by the respective municipal council at its ensuing meeting.

Art. 11. The municipal councils of Panama and Porto Bello shall, every three months, class the stores and shops for the sale of foreign merchandise or productions; and shall then transmit lists of the persons contributing, and of the number of the stores and shops, to the collectors, in order that they may note the patents issued; and shall express the sum to be paid by the patentees from the day on which the classification is made.

Art. 12. The municipal councils of Panama and Porto Bello shall divide the stores into three classes: those of the first shall pay twenty-four dollars per month; those of the second, twenty dollars; and those of the third, sixteen. The same councils shall also divide the shops into four classes: those of the first shall pay eight dollars per month; those of the second, six; of the third, four; and of the fourth, two dollars each.

Art. 13. This law shall not begin to be in force until a free communication has been established between the two oceans through the cantons of Panama and Porto Bello, either by a canal or by a railroad; and the period designated in the first article shall commence from the day on which the said cantons enter upon the enjoyment of the privileges conceded to them.

Given at Bogota on the 25th of May, 1835.

BLAS AROSSEMENA,
President of the Senate.
EZEQUIEL ROJAS,
President of the House of Representatives.
FRANCISCO DE P. TORRES,
Secretary of the Senate.
RAFAEL M. VASQUES,
Deputy Secretary of the House of Representatives.

Bogota, *May* 25, 1835.

Let it be executed and published.

FRANCISCO DE PAULA SANTANDER.

By his excellency, the president of the republic:

FRANCISCO SOTO.

Secretary of State of the treasury.

PANAMA, *December* 7, 1835.

GENTLEMEN: I thank you most sincerely for your kind offers of assistance in procuring accurate information relative to the situation and prospects of the South American republics.

The favorable revolution in the political condition of your country has very naturally attracted the attention of other nations towards the commercial and agricultural improvements expected to flow from such an improved state of your foreign relations. Blessed as you are with a soil producing in abundance the most valuable fruits and minerals in the world, with a free government, and a virtuous people, your march to greatness can only be impeded by a neglect of your own ample resources.

I have subjoined a few questions hastily thrown together for your perusal; but you will please not confine yourselves in your answers within those narrow limits, but freely and frankly afford me every information in your power as to the present condition and future prospects of the South American States.

I have the honor to be your most obedient servant,

CHARLES BIDDLE.

To the PRESIDENT AND DIRECTORS
of the Society of the Friends of the People.

Questions addressed to the committee of the Society of Friends of the People, of Panama, December 7, 1835.

1. What are the geographical boundaries of New Grenada; what its number of square miles; what proportion is fit for cultivation, and how much is actually cultivated?

2. What quantity of land belongs to the government; and, at its present valuation, what reliance could be placed upon it as a fund for the extinguishment of your State debts?

3. What is the population of New Grenada? In answering this question, please designate ages, sexes, and color, as nearly as practicable.

4. What were the annual amounts of exports and imports during the last year, and of what do they consist? and if they have increased or decreased within the last ten years, state the causes for such variations.

5. What is the annual revenue of the State; and what are the subjects of taxation, and the amount produced from such source; what are your municipal and local taxes?

6. What is the church revenue; whence derived, and how applied; what the number of ecclesiastics, and what their compensation?

7. How are your executive, legislative, and judiciary departments organized; what the number of judges, their jurisdiction and compensation; what is your regular *military* force?

8. As there has evidently been at one time an *artificial* road from Panama to Cruces, and as I find no mention made of it by Hum-

boldt or other travellers, you will please inform me by whom, and when, it was commenced, its original cost, and the uses for which it was originally designed—whether for military or commercial purposes.

9. What is the relative extent and population of the two provinces of the isthmus (Panama and Veragua) compared with the residue of the State; is there much commercial intercourse between those provinces and the residue of the State; are their interests identified together, or are they not frequently in conflict with each other?

10. With which of the South American States has the province of Panama the most lucrative trade?

11. As your society have, doubtless, reflected much upon the subject of a communication by canal, turnpike, or railroad between the Atlantic and Pacific oceans, you will much oblige me by furnishing any maps, prints, or manuscripts which treat upon that matter, and also your own opinions at length, as to the advantages or disadvantages attendant upon all the projects which have been formed in all parts of South America.

In order to avoid an unnecessary multiplication of questions, permit me to say that you will confer a great favor upon myself, individually, and perhaps serve your own country, by entering into a full discussion upon the subject of these proposed improvements, and furnishing me with such details as are within the reach of your enlightened society.

Report of the select committee to the eleven questions proposed by Colonel Charles Biddle to the Society of Friends of the Country, at Panama.

[Translation.]

PRESIDENCY OF THE SOCIETY OF FRIENDS OF THE COUNTRY,
Panama, January 10, 1836.

SIR: The report offered by a committee of the society over which I have the honor to preside, to the questions in your note of the 7th December last, accompanies this, after having received the approbation of that body in an extraordinary session of the 2d instant.

The society is sensible that it has not fully answered the different points called for by your note; but the want of statistical data in New Granada, the natural consequence of her infancy, has prevented the full development of the desire which animated the committee; thus, no imputation of negligence, or the absence of frankness will, I hope, be applied to their answers.

Being charged to attend to the inquiries made by you in the first part of your letter, respecting the actual position of the South American republics, and their future prospects, I must, before entering upon the subject, freely confess that this difficult question

requires more than the insufficient glance which, in a political point of view, I direct to points not only distant, but, for the greatest part, not in communication with us.

The most authentic papers offer the information which I now succinctly communicate; but they do not contain large details relating to the interior economy of the countries I now allude to.

The republic of Venezuela continued her constitutional career for more than five years, and promised the progressive advance of a state favorable to her revenue and the spirit of her liberal institutions; but a large portion of those elements of discord which formerly agitated Colombia has caused a revolution in Caraccas, which will soon be quelled if the government of Venezuela acts with that energy she has shown. From this partial difficulty an immense benefit will arise, by which, in future, such political dissensions will be prevented, chastising the conspirators in an exemplary manner.

Equador has just emerged from a horrible struggle, which terminated by a change in her constitution; and it may be believed that, after the troubles of every description which affected that State, her inhabitants will aid in maintaining order, to repair the losses they have experienced, giving vigor to her agricultural industry, which is the basis of her national riches.

The republic of Central America has been the scene of anarchy for many years, but, for some short time past, consolidated; her institutions procuring reforms by pacific measures.

It is worthy of observation, that while intestine war desolated the States of the Federation, that of Costa Rica made considerable advances in agriculture and commerce, under the auspices of peace, never for one single instant interrupted.

A military chief overturned the established government of Peru: she is now engaged in a most sanguinary and disastrous war, in which the republic of Bolivia has taken part. Previous to this unfortunate event, Peru had given laws which greatly stimulated her mining operations and her commerce. It may be predicted that the intervention of the sister republic, far from injuring the cause of liberty, will serve to establish the prosperity of that rich country.

Bolivia, exempt from the injurious effects of rebellion, has been able invariably to fulfil her duties. Free from public debt, and animated by the spirit of mercantile freedom which enriches nations, the Bolivian republic is, to a certain extent, the admiration of the rest of South America.

Chili was the first amongst us that was aware of the importance of promoting free trade with an open port, and she is the first that has had the fortune to reunite in Valparaiso a prodigious number of vessels, which has caused, as it will continue to do, that beautiful country to flourish. Although at the commencement of her revolution she was subjected to those fluctuations and political oscillations too common to countries obliged to conquer their independence by arms, she now reaps the benefits which a good government diffuses in the midst of a tranquillity which it is to be hoped will endure.

Buenos Ayres desiring a government, by chance, more perfect than is possible in her circumstances, became involved in questions of internal policy, while temporarily disapproved, to be revived again with equal excitement. If my opinion is well founded, as soon as that republic forms a system adequate to her situation, the troubles which affect her will disappear at once; and, by favor of the influence and the gifts with which nature has distinguished her sons, the Argentine republic will be elevated to the highest pitch of prosperity.

Opulent Mexico, which should take the lead of all the new republics, unhappily retroceded from her first constitutional career. The victim of military despotism, (as at one time was the case with Colombia,) she struggles against her dictator. The patriots of this continent offer vows for the establishment of the power of the laws. All who are acquainted with that rich and vast country, will not hesitate to believe that a few years of profound peace will be sufficient to heal the wounds which anarchy has inflicted.

The report of the committee has enlarged upon the subject of New Grenada; but it will not be amiss for me to say a few words of the brilliant career she has pursued since she constituted herself an independent republic. The dictatorship was destroyed, but the remains of that power struggled to overthrow the new government; but on two occasions, its energy, and the popularity with which it is surrounded, triumphed over the malignant designs of the conspirators. It is not to be presumed that a State which has repelled with vigor the attacks of its enemies at the moment of its creation, will yield, now it is consolidated, to the attempts of the discontented, at this time few in number and destitute of courage.

In concluding this note, I congratulate myself in presenting you my most grateful thanks for the favorable impression this country has made upon you. We hope to have, in the United States of the north, faithful friends and protectors of the great enterprise of forming a communication between the two seas; and in you, an active agent who will promote commercial prosperity.

With sentiments of profound respect and consideration, I subscribe myself your obedient servant,

M. AROSSEMENA.

Colonel CHARLES BIDDLE.

MR. PRESIDENT AND MEMBERS: The special committee named to answer the note of Colonel Charles Biddle, containing eleven principal questions, from which arise others subsidiary to them, respecting geographical, political and statistical details of New Grenada, and the actual situation of the other South American republics, have finished their report according to the best information they have been able to obtain in the short space of time allowed them; but they have not been able to fulfil the extent of their wishes, from the want of well regulated and sufficient statistical information upon this country.

To assist the comprehension of the answers, which follow in succession, the committee thought it useful to adopt the system of affixing to each question its respective solution, in the numerical order established by Colonel Biddle.

Question 1. What are the geographical boundaries of New Grenada; the amount of square miles; what proportion of the same is adapted for cultivation, and the quantity actually under cultivation?

Answer 1. The geographical limits of New Grenada are—to the north, the Atlantic ocean and the republic of Central America; to the south, the State of Equador; to the east, the republic of Venezuela; and to the west, the Pacific ocean.

We cannot enter into details respecting the boundaries of Venezuela and Central America, because there are now pending special treaties to conclude and fix them in the same manner as with Equador, where the river Chordie has been taken as a line of division. The non-conformity in the data respecting territorial extension, which is found in the different geographies which we have consulted relative to the ancient vice-royalty of New Grenada, causes us doubt the correctness of all of them; and, for want of good private maps containing a survey of the republic, we have thought it correct to take the medium calculation of three hundred and fifty thousand square miles. Among the opinions which enjoy the greatest credit, some authors concede to New Grenada an area much larger, but such calculations are evidently exaggerated.

The fertility of New Grenada induces us to answer that, excepting the peaks of the Andes covered with snow, some mountains of rocks, and the mineral regions, the remainder is adapted to the cultivation of the products of both zones. It is impossible to gain exact information of the portion susceptible of, and that actually in, cultivation; for we are altogether deficient in statistical data to guide us in this respect; and with the scanty population of New Grenada, it is very difficult to gain such intelligence; all that we can decide is, that the greater part of the territories of New Grenada lies completely uncultivated.

Question 2. What quantity of land belongs to the government; and, according to its present price, what confidence may be placed upon it as a fund for the extinction of the national debt?

Answer 2. The public lands are of very considerable extent; but not having a good map of the republic, as we have before remarked, we can neither define their limits nor calculate the number of *fanegadas* which belong to government. The government has fixed the minimum price of land at one dollar the fanegada* in the interior, and two dollars on the coasts and the banks of navigable rivers. In the present state of our population, this price may be considered high; but there is every probability that they will increase in value.

By a law of ancient Colombia, the receipts from sales of land

* A fanegada of land is one hundred yards square, or ten thousand square yards.

stand accredited to the national debt. This law is in force in New Grenada, and these lands can be bought with the bonds of the consolidated debt, with every security in the title and possession. The product from the lands subject to amortization of the debt is the best pledge which can be given for both debtor and creditor, and offers an ample security. If the debt were divided among the provinces, even the smallest would certainly possess, with its land, sufficient to pay its proportion.

The want of population, and repeated domestic troubles, have retarded to this time the consolidation of a good government, which has been the cause why no speculations have taken place in the purchase of land, and that we do not know the real value of this luxuriant fountain of national wealth. The government may dispose of a number of millions of fanegadas of land, with less than a fourth part of which all the debts can be paid; and we believe that every confidence may be placed in the extinguishment of the national debt, since the value of the government lands* is more than sufficient to secure and, in time, to cancel the debt, without reference to other branches of the public revenue and their surplus, which can be applied to this purpose.

Question 3. What is the population of New Grenada? and, in answer, please to designate, as nearly as possible, ages and sexes.

Answer 3. According to the general census of the republic, published in the Gazette of New Grenada, No. 211, her population is one million six hundred and eighty-seven thousand and nine souls; which census does not classify ages and sexes, although the secretary for home and foreign affairs declares in a note that such would be published hereafter; but, as this province is particular in that respect, we will give the extract. The province of Panema contains seventy-two thousand six hundred and sixty-five inhabitants, of the following classes:

Secular and regular ecclesiastics	53
Married men	7,157
Youths and male children	15,905
Unmarried men from 16 to 50	9,063
Unmarried men above 50 years	1,450
Married male slaves†	170
Unmarried male slaves	542
Friars	4
Married women	7,930
Young women and female children	16,317
Unmarried women from 16 to 50	11,212
Unmarried women above 50	2,281
Married female slaves	153
Unmarried female slaves	428
	72,665

*The committee believe that the land occupied by the cattle of the church also belongs to the government.

† The number of slaves largely diminishes in virtue of the manumission law. We should

Question 4. What has been the amount of imports and exports during the last year, and of what do they consist? Has there been an increase or decrease within the last ten years, and the causes of such variation?

Answer 4. The importations to the isthmus during the last economical year, from the 1st September, 1834, to 31st August, 1835, have amounted to $178,642 93¾, consisting of the following articles, according to the cited law:

Of the first class	$2,538 31¼
Of the second class	140,809 93¾
Of the third class	4,202 28
Of the fourth class	290 84
Of the fifth class	2,201 03
Of the sixth class	1,450 31¼
Not designated in the above	3,239 68¾
Specific articles	23,950 53
	$178,642 93¾

The exports, for the same period amounted to $363,869 68¾, as follows:

Grass hammocks	$48 00
Tortoise-shell	3,004 00
Hides	1,400 00
Horns	300 00
Mother-of-pearl	1,960 00
Shells	50 00
Catgut	20 00
Tanned hides	308 75
Ropes	4 50
Straw hats	9,794 00
Pearls	34,075 00
Coined silver	64,202 00
Powder	200 00
Gold dust and jewels	16,913 62½
Silver plate	13,114 75
Coined gold	216,108 00
Boards	447 00
Sarsaparilla	1,920 00
	$363,869 68¾

At first sight, it appears that the commercial balance is in favor of the country, since the exports exceed the imports to the amount

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also observe that ten to fifteen thousand souls may be added to the population; for in the towns, as well as in the country, it never happens that there is an exact census, from the concealment by the inhabitants of their children and dependants, and the difficulty of finding those who live in remote places in the mountains, where they cannot readily be followed.

of $185,226; but, if we examine whence this surplus arises, we perceive that it consists of the transit trade, or of specie remitted by the merchants of Guayaquil to those of Jamaica, St. Thomas, &c.; and hence we are assured that the balance is against the isthmus, as by the following calculation:

Real products exported from the isthmus.

Hammocks	$48 00
Tortoise-shell	3,004 00
Hides	1,400 00
Horns	300 00
Mother of-pearl	1,960 00
Shells	50 00
Catgut	20 00
Tanned hides	308 75
Rope	4 50
Pearls	34,075 00
Gold dust and jewels	16,913 62½
Boards	447 00
Sarsaparilla	1,920 00
	$60,450 87½

Suppose, for a moment, that the sums thus stated by the custom-house, or rather the values received for the articles imported, are not correct, (for, with the exception of the above articles, amounting to $60,450 87½, of gold dust and jewels, no others pay duties;*) still the difference would not be more than $20,000, making $80,450 87½. Thus it is shown that the commercial balance is against the isthmus to the amount of nearly $100,000 more than the exports. It is impossible to obtain data necessary to show the amount of the importations and exportations during the last ten years; but the officers of the customs have provided the committee with that of the last five years as follows:

	Imports.	Exports.
1830 to 1831	$305,209 31¼	$258,290 09
1831 to 1832	155,914 00	210,038 00
1832 to 1833	245,719 28	233,809 00
1833 to 1834	117,396 37½	87,503 62½
1834 to 1835	178,642 96½	363,869 68¾
Five years	$1,002,837 93¼	$1,153,511 28¼

*The custom-house here mistook when it thought to require a duty, imposed by an ancient law, to be paid on gold and silver not coined, causing a heavy loss to the transit trade and to this province, thus deprived of advantages which passengers from South America, Europe, and the Antilles could afford. By a new law of the year 1834, all kinds of metals are exonerated from every duty, in the same manner as other merchandise.

Articles of transit only.

1830 to 1831	$161,231 87½
1831 to 1832	102,558 26½
1832 to 1833	182,302 12½
1833 to 1834	91,178 43¾
	$547,270 82½

It must be observed that the amount of duties does not proceed from all the merchandise which has been introduced, but from that portion only which is destined for the consumption of the country; and that those of transit are importations destined for Guayaquil, Paita, &c.

The amount of transit merchandise is only brought up to 1834; for the duty of two per cent., formerly paid, being now abolished, the custom-house keeps no account of their value, and only notices the entry and export of the packages. In the present year, however, the committee are assured that the transit of goods has been very considerable, and believe they do not exceed the limits of truth in stating the amount destined for Guayaquil, &c., at from three to four hundred thousand packages, valued at from $200,000 to $250,000, without confounding them with the importations made for the consumption of the country, which, according to the above calculations, amount to $178,642 09, contained in from two thousand to two thousand five hundred packages.

The committee will now enter upon the several parts of the question, whether the importations have increased or decreased within the last ten years; and they declare, with regret, that they have considerably diminished; which can be attributed to no other cause than to the great trade which is now carried on by the way of *Cape Horn*, in consequence of a deficiency of good means of communication between the two oceans at the isthmus.

The commerce of the southern coasts of Mexico, Central America, Quito, greater part of Peru, and Guayaquil, which formerly had its course by this route, is now taken round Cape Horn; and thus it is that now commerce is limited to the small traffic of the provinces of Panama and Veragua, and the transit trade to Guayaquil, which every day becomes less, from the difficulties which attend upon the wretched state of the roads. The exports of produce from the country have, on the contrary, increased; as some speculators have managed to discover articles which are of value in foreign matters, such as horns, sarsaparilla, mother-of-pearl, dye-woods, fine shells, &c.

Question 5. What is the annual revenue of the republic, and what objects are charged with duties, and their amount? What are the local and principal imports?

Answer 5. According to statement No. 1, presented to Congress in the year 1835 by the secretary of finance, in his report, it ap-

pears that the revenue of New Grenada had increased during nine months, from December 1, 1833, to 31st August, 1834, $1,740,904.* The articles subject to taxation are those designated in the law of the 5th of June, which accompanies this. We may add that all the products of New Grenada are now free from export duty, and some have the advantage of a bounty.

The provincial, municipal, and commercial imports are those from different bridge tolls, passage money, boat and ferriage charges, in conformity to the respective tariff regulations formed by the two provincial chambers and the municipal and commercial councils, and the charges which they levy upon cattle of every description, both alive and dead, that are consumed in each town; besides which, they impose upon storehouses, shops, groceries, apothecaries' shops, public houses, liquor stores, and other similar establishments, as well as upon billiard tables, cock-pits, and other games permitted by law; upon water taken from the public aqueducts, theatres, public exhibitions, and other legalized diversions which are offered to the public for the advantage of individuals; and, finally, there are charges made upon mills for grinding wheat. Some of these branches of revenue with which the province of Panama is burdened produce $10,000 yearly.

Question 6. What are the revenues of the church; whence do they proceed, and how are they applied? What is the number of ecclesiastics, and their compensation?

Answer 6. Being without satisfactory references, the committee, in answer to the first part of the question, will limit themselves by stating, in general terms, that the wealth of the clergy of New Grenada consists, 1st. Of the individual contributions, &c., which amounted, in 1833, to $225,000, of which the government receives one-third part. 2d. The impost of the firstfruits,† which burdens the agriculturists in their grain crops in a very unequal manner; for he who harvests seven fanegas of such produce, pays the same amount as he that has an unlimited number; both are obliged to satisfy the curate with one fanega or measure of grain. 3d. The pious foundations (*imposiciones*) which in former times were established individually for themselves and the clergy, on country and city property, as securities, bearing interests of 5, 3, and 1½ per cent. 4th. In the exercise of some ceremonial functions, as marriages, burials, funeral honors, panegyrics, and masses. In the isthmus of Panama we may calculate the foundations of revenues and fraternities at $2,500,000; but a large portion of the rents is not paid, from decay of the properties and of the country. The funds of convents suppressed by law have been destined for public education in the whole of New Grenada.

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* It having been ordered by the law of 23th May, 1834, that the economical year should be computed from the 1st of September to the 31st of August, and that all current accounts should be closed on that day, the statement of the amount of exports and imports furnished by the secretary of finance is thus confined to the nine months from 1st December, 1833, to 31st August, 1834.

† Cocoa and coffee plantations are exempt from the charges of tithes and firstfruits, in order to protect these branches of agriculture.

The committee want information with regard to the exact application of the church revenues, and the income of her ministers; but it must be observed that our bishops, prebends, and curates, do not enjoy, as in other parts of America, very considerable allowances. When any of the bishoprics, canonships, or curacies are vacant, the government receives the tithes which appertain to them.

In speaking of the general revenues of the republic, we have already stated that there are no details to ascertain the number of ecclesiastics, and can only report that the isthmus contains fifty-three, among whom are some friars; of this last class, there are scarcely in all New Grenada two hundred and fifty.

Question 7. How are the executive, legislative, and judicial departments organized? what are the number of judges, their jurisdiction, and compensation?

Answer 7. The government of New Grenada is republican, popular, representative, elective, alternative, and responsible. The supreme power is divided by its administration, into legislative, executive, and judicial. The legislative power is exercised by a Congress formed of two chambers, one of Senators and one of Representatives, whose residence during the sessions is in Bogota, the capital of the republic. The republic is divided into provinces, cantons, and districts. In each capital of a province there is a provincial chamber, which meets in the month of September each year to discuss local affairs. The municipal body, which is formed of the chiefs of cantons, have only power to frame cantonial laws, decrees, and ordinances; and the common councils, of which there is one in each district, can only issue those required by each respective parish.

The executive power is exercised by the president, and, in his absence by the vice president. These functionaries reside in the capital. In each of the capitals of provinces there is a governor, who depends directly on the executive, and through him are communicated to the provinces all superior resolutions, in the same manner as they are communicated to the cantons by the political chiefs, who are the immediate agents of the governor; and in the parishes by magistrates of the parish, who depend on the political chief of the canton.

The judicial power is exercised by a supreme court residing in the capital, composed of three judges, a fiscal, or attorney, and a relator and secretary, who have the following allowances:

Three judges, each $2,400 per annum.....	$7,200
One fiscal.....	2,400
One secretary relator.....	800
	$10,400

In the supreme tribunal, all causes are decided after passing through the district courts, composed of similar officers, who receive annual salaries in seven districts, amounting to from $5,700 to $8,500 per annum in each district. Besides the judges of each district court, there are likewise others who aid the fiscal in his

labors, called adjunct fiscals, who, in seven of the provinces, receive from $300 to $600 per annum, amounting to $3,300.

These district courts have cognizance of all civil and criminal causes in the second instance. The judge advocates, of whom there is one in each capital of a province, has, in the first instance, all civil and criminal causes that have relation to the public property, and receive salaries in twenty provinces, of from $800 to $1,500 per annum, amounting to $20,300.

There are also in the chief towns of the cantons cantonial judge advocates; these decide, in first instances, all civil and criminal causes appertaining to the citizens of the cantons. Those employed receive pay when the municipal fund will afford it; and when there is a deficiency, the municipality nominates some one of their own body to exercise this office, who consults an advocate upon points subjected to his charge.

The parochial magistrates, of whom there is now one in each district, cannot judge claims of an amount exceeding two hundred dollars; and their jurisdiction does not extend beyond the limits of the parish. They do not receive pay, it being an office for advice and counsel, as is also that of justice of the peace, whose business it is to endeavor to bring all causes to an amicable conclusion, without reference to the courts.

For the trial of purely military offences councils of war are held, according to the regulations of the army. If the delinquent is an officer, the council is composed of generals, colonels, and lieutenant colonels. The sentence must be confirmed by the supreme court martial, composed of ten officers of the before mentioned grades. Should the prisoner be of the rank of sergeant, and thence downwards, the court is formed of captains, and, in the absence of such, any other subalterns (always preferring those of the highest rank) may take their place; and the sentences must be approved by the tribunal of the corresponding district, (only held in Candinumarca, Cauca, and Magdalena,) composed of two officers of a lieutenant colonel's grade, to form a superior military court.

All ecclesiastical affairs are decided in the first instance by the bishop or vicar general, and admit of appeals to other bishops, as is arranged by the laws.

Commercial affairs are decided by a tribunal composed of the judge of first instance, and two merchants chosen by the contending parties; their sentence to be founded on known truth and cautious equity.

Question 8. As it is obvious that there formerly existed an artificial road from Panama to Cruces, and I believe neither Humboldt nor any other traveller makes mention of it, I will thank you to inform me by whom and when it was begun, its original cost, distinctive object—whether for military or commercial purposes?

Answer 8. We cannot entirely doubt that the road from Cruces to this city was once exceedingly commodious for the passage of droves of cattle or beasts of burden; but there is no proof, neither is there any appearance, of its having served for wheel carriages. We are ignorant of the period when it was constructed, and what

was its original cost; although in the archives of the governor, by whose direction it was made, these records should exist, unless they have been destroyed by the fires of 1737 and 1756. There can, however, be little hesitation in deciding that the destination of this road was for the transit of the great commercial intercommunication of some past time. It afterwards became a channel for the passage of troops and the munitions of war, as well as for commercial purposes.

Question 9. What is the relative extent and population of the two provinces of the isthmus, compared with the rest of the republic? Is there much commercial intercourse between them and the other parts of the State? are their interests identified, or are they frequently in conflict with each other?

Answer 9. We cannot tell by the maps we have seen the quantity of miles square contained in the isthmus, as the geographical charts which have been formed have for their principal object a knowledge of the coasts of the Atlantic and Pacific, neglecting exact calculations of the interior. The maps being also on a small scale, are not fit for measurements of this nature; hence a comparison between the territorial extension of the isthmus and that of the rest of New Grenada is not practicable.

According to the census formed this year, the population of the isthmus is, with the whole republic, as 115,179 is to 1,687,009.

Question 10. With what South American State has the province of Panama the most lucrative trade?

Answer 10. Among the commercial interchanges existing between the provinces of the isthmus and others of the republic, it is necessary to mention, as of some importance, the importation of beef, tallow, soap, sole leather, and other articles natural to or the results of the industry of the canton of Alonje, in Veragua, to the shores of the province of Choco, which gives in return the products of her mines. The traffic is pre-eminent in its character, as the canton of Alonje abounds largely in cattle and hogs, while Choco does not possess any, nor soil suitable for their nourishment. The traffic in fruits and foreign merchandise between the provinces of Carthagena and Panama has diminished, and is now reduced to a few exchanges between Porto Bello and Chagres. The peace which New Grenada has enjoyed since she constituted herself an independent republic is the result of a conformity of opinion among the great majority of the nations; and, consequently, the people, understanding the advantages derived from their union, have a common interest in the preservation of order and of their liberties. We, therefore, have no fears that those disturbances occasioned by the dictatorship, by which the existence of the government might be compromised, will be now repeated.

Since the decay of the profitable trade that the isthmus of Panama sustained for many years with Peru, the south of Mexico, Central America, and Equador, she is limited in her mercantile transactions to a moderate traffic with the last. From the time that our communication from one sea to the other was allowed to get out of order, and the transit goods were subjected to heavy duties, the

navigation around Cape Horn became better known, and the governments of South America, increasing the freedom of trade, ended by stimulating the passage by that route.

Such are the causes that influenced the decay of the trade of Panama; but, being solely the effect of circumstances, no doubt they will disappear with the existence of a law giving freedom of trade which was promulgated by the last Congress, and, above all, by opening a good communication across the isthmus. Then will she recover her ancient splendor, and we may predict that she will surpass that which she possessed in the time of the galleons, and afterwards during the occupation of Spain by the troops of Napoleon; for an unlimited freedom of trade should bring to this point the valuable productions of India for the commerce of Europe and America in general.

Question 11. As your society have doubtless naturally considered the subject of a communication between the Atlantic and Pacific ocean, by a canal, rail, or other road, you will much oblige me by furnishing any maps, prints, or manuscripts, which treat upon this matter; also, your own opinions at length, with respect to the advantages or disadvantages of the different projects which have been formed in all parts of South America. To avoid unnecessary multiplication of questions, allow me to say that you will confer on me individually a great favor, and probably be of much service to your own country, by entering into a full discussion upon the subject of those proposed improvements, and by furnishing those details which are within reach of your enlightened society.

Answer 11. We have pleasure in sending you a plan, formed by Señor Domingo Lopez, of his examination of the ground between Porto Bello and Panama, made at the expense of the municipality of this canton.

You invite us to express our opinions respecting the advantages or disadvantages of the different means of communication which have been projected through this isthmus. We will now consider them.

A canal that would unite the waters of the river Chagres with those of the river Grande, by means of the river Obispo, has been reputed to afford the shortest and most permanent communication of any that have been *imagined*, and is that which the Baron Theirry solicited to open. He obtained a privilege conceded by the legislature of the last year.

A railroad from Porto Bello to Panama has also been reported as of immense advantage; but the heavy cost of levelling and consolidating the ground, as well as for furnishing the wood, makes the undertaking difficult.

A mixed communication, taking advantage of the river Chagres as far as Cruces for steam navigation, and a road according to the plan of Mr. McAdam from that parish to this city, for the passage of carriages, is, in our opinion, the most economical of all, and capable of most prompt execution. Besides these projects, no other of those that have been conceived to unite the two oceans through the river Atrato, and by the Lake Nicaragua, appears to

us worthy to occupy the attention of any enterprising person, considering the facilities which the narrowness of the isthmus and the lowness of the cordilleras of the Andes offer.

JOSE AUGUSTIN ARMIGO,
MO. AROSSEMENA,
MANUEL QUESADA,
J. B. FERRAND,
L. LEWIS,
JOSE DE OBALDIA,
Dr. JOAQUIN MORRO,
PEDRO JUAN DE YEAZA,
JUDEO PERES DE OCTROAS SICILIANO,
TOMAS HERRERA.

C.

BOGOTA, *March* 16, 1836.

DEAR SIR: I send you by the bearer copies of a correspondence between myself and certain distinguished citizens of Panama, in which you will find much useful information relative to the statistics of New Grenada.

The sympathy always felt, and long since expressed by the government of the United States towards this portion of South America whilst struggling against foreign oppression, and the strong desire of our citizens to cultivate the most friendly relations towards a brave and magnanimous people endeavoring to establish their rights and prove their ability for self-government, have induced, on the part of our commercial community, a spirit of inquiry as to the actual condition of New Grenada, which I hope will be equally beneficial to both countries.

My knowledge of New Grenada enables me to assert, without the fear of contradiction, that she possesses vast resources, from which might be drawn the elements of individual and national wealth, if the citizens of her agricultural districts could find a ready market for the products of their industry; but I have remarked, with deep regret, that agricultural industry, which is destined one day to constitute the strength and power of the republic, now languishes for the want of those facilities which are so essential to the prosperity of both agriculture and commerce.

Upon looking at the map of New Grenada, we are struck with the peculiar felicity of her geographical position, bounded, as she is, by the Atlantic and Pacific oceans, and intersected by their vast tributary streams; but it is melancholy to find that large portions of her fertile valleys remain uncultivated, which, by the exercise of moderate industry, would sustain an immense population of free and independent citizens.

The State of New Grenada having recently emerged from a protracted warfare, in which a large amount of public debt was con-

tracted, finds herself in a situation unprepared to execute those great works which are calculated speedily to develop her own resources. The citizens of the United States of North America, on the contrary, having enjoyed the benefits of free republican institutions for more than half a century, find themselves free from debt, and in a condition and with a strong desire of promoting the interests of New Grenada; but the pecuniary means of accomplishing these objects are to be obtained by corresponding concessions on the part of the southern republic, and the good sense of those who control its destinies will, no doubt, lead them to a proper decision.

Next to the enjoyment of civil liberty itself, it may be questioned whether the best organized government can assure to those for whose happiness all governments are instituted a greater blessing than an open, free, and easy intercourse with one another by land and water communications. These facilities for extending commerce have a tendency to promote the agriculture and manufactures of a nation, and thereby augment its wealth and population. They yield to the former an increased price for the products of the soil, and an augmented value to the soil itself. They afford to the manufacturer and merchant a more extensive and diversified demand for their industry and capital. They tend to diffuse useful information universally among the people, and to strengthen the cords of social union. But, in addition to all these advantages, there is another, of peculiar importance to a government possesed of immense bodies of public lands, which, by proper management, might be relied upon for the certain and speedy extinguishment of its national debt. The multiplication and improvement of the channels of useful intercourse afford the means of exploring the national resources of a country, and invite the genius of speculation to fit them for the use of man; lands too remote from market to tempt cultivation, forests hitherto regarded as inaccessible, beds of minerals and fossils unknown or neglected, are brought within the reach of ordinary enterprise, and rendered subservient to the comfort and convenience of the citizens.

In considering how far the public lands may be made available to the extinguishment of the public debt, the state of New Grenada might derive a useful lesson from the historical fact that, from the period when the United States commenced their system of internal improvement, up to the present year, the revenue derived from the sales of public lands has increased from $400,000 per annum to the enormous sum of $11,000,000 during the year 1835. The true basis of all commercial intercourse between independent nations is that of reciprocal benefits; and it is idle, in the present enlightened state of society, to refer the origin of treaty stipulations to any other motives than those of securing peace and promoting the mutual interests of both the contracting parties. Acting under these impressions, I can with great sincerity affirm that, in proposing the project which I have submitted to the citizens of Panama, I accurately estimated the advantages to both parties, and am convinced it will result in mutual benefit; which, as I have

before remarked, is the only firm basis upon which all contracts are to be established. It appears to me that the long contemplated project of uniting the Pacific and Atlantic oceans by a ship navigation, must be reserved for the patriotic exertions of a future generation, when the union, prosperity, and resources of South America may be sufficient to accomplish that project, without regard to its expense, or the revenue which it may yield. At present, no well advised private capitalists could enter into such a scheme without the prospect of utter ruin. The question, then, is, whether New Grenada will follow the example of Spain, and wait patiently for another century to carry into effect a visionary scheme; or whether she will cordially unite in securing a most important benefit for the present generation.

I deem it unnecessary, upon the present occasion, to enter into any minute details as to my contemplated improvements, because it is not my intention to make them the subject of public discussion, until assured that they will receive the sanction of those most interested in the welfare of New Grenada; but, as various rumors have been circulated upon the subject, it will be proper to state to you that, upon certain conditions, I propose, by means of steamboats and good roads, to carry in safety, every day in the year, in about twelve hours, any quantity of merchandis , not exceeding one hundred tons, from the Pacific to the Atlantic ocean, at a price far below that which is now paid for a dangerous, dilatory, and uncertain conveyance.

In addition to this, I propose making a railroad from Carthagena to the mouth of the Cauca river, or some other point north of that, which shall, in my opinion, best secure the safe conveyance of the valuable productions of New Grenada to the Atlantic ocean—an object so important to a large portion of the State as to require no comment.

I have the honor to be your obedient servant,

CHARLES BIDDLE.

To the Hon. Robert B. McAfee.

E.

[Translation.]

Bogota, *May* 19, 1836.

Sir: I am directed by Mr. Lino de Pombo, secretary of state for the home and foreign departments, to communicate to you, according to the orders of his excellency the president of the republic, that a petition, signed by some respectable merchants and inhabitants of this city, has been addressed to the government, in which, with reference to the bill that has been approved by both the legislative chambers, containing a privilege in your favor for the opening of an expeditious communication between the Atlantic and Pacific oceans through the isthmus of Panama, they make the

most advantageous proposals to realize the said enterprise, offering at the same time similar securities.

The petitioners accept of the privilege approved of by the chambers, offering to New Grenada the following advantages:

1st. To reduce the number of years to forty-five, instead of fifty.

2d. To receive gratuitously only twenty square leagues of vacant lands in the isthmus, instead of forty; and to content themselves with only one hundred square leagues of the same lands, instead of two hundred; and to buy them at the rate of a dollar each fanegada.*

3d. To reduce to a third the transport duties, which should be paid, according to the tariff, by the public officers and the national property of New Grenada, instead of the *half* assigned by the decree.

4th. To grant to the republic two per cent. of the yearly produce of the road as soon as it is finished.

The above mentioned petitioners also promise to give the securities required by the decree which grants the privilege. They wish for their petition to be taken into consideration according to the constitution and laws of the country. They solict that notice should be given to them if anybody else offers any conditions more advantageous than theirs, and promise to better them in case of competition.

The executive power could not disregard such an appeal and such a proposal, without incurring a direct responsibility, at a time when he has not yet sanctioned the bill approved of by the chambers, especially as he has not the faculty of making objections to it, to have it reformed as may best suit the interests of the republic. Mr. Lino de Pombo has, therefore, been authorized to give you notice of the above said proposals which have been made for the opening of an expeditious communication through the isthmus of Panama, with the purpose of knowing whether you are disposed or not to accept the same conditions, or some others more advantageous to New Grenada. Mr. Pombo is ready to give you all those verbal explanations on the subject which you may deem necessary. Should it be so, you may call at the foreign office this afternoon at half-past three o'clock, or to-morrow at half-past nine. You will be good enough to send a previous notice, in the event of your wishing to see Mr. Pombo. It will be pleasing for him to be able to remove, with such explanations, all the difficulties that you might perhaps find to continue, on conditions more advantageous to the republic, the most important enterprise which the decree that grants the privilege makes reference to.

At Mr. Pombo's request, I have also to tell you that every new proposal that you may intend to make, ought to be addressed to him; that, whatever new conditions you may agree to, they ought to be consigned to paper, and authorized by your own signature; and that they ought to be submitted to the consideration of the

*Ten thousand Castilian square yards.

president as soon as possible; because the executive cannot delay for a longer time than eight days the sanction or rejection of a bill enacted by congress.

I avail myself of this opportunity to give you a testimony of the high esteem and consideration with which I am, sir, your most obedient, humble servant,

LORENZO M. LLEARAS,
The Chief Clerk in the office of the Secretary of State for the Home and Foreign Departments.

To Colonel CHARLES BIDDLE.

F.

BOGOTA, *May* 19, 1836.

DEAR SIR: I have this moment received your note, in which you propose an interview beween myself and his excellency Mr. Pombo, relative to an act of Congress recently passed for opening a communication between the Atlantic and Pacific oceans.

My present impressions are, that, agreeably to the constitution of New Grenada, the executive power does not possess the ability to *modify or alter* an act of Congress, but merely to reject or approve the decree of the representatives of the people. Whatever that decision may be, shall be submitted to without a murmur from me, except as to *the manner* in which it was brought about.

I am your obedient servant,

CHARLES BIDDLE.

L. M. LLEARAS, Esq.,
Chief Clerk in the Office of Foreign Affairs.

G.

[Translated from the "Gaceta Extraordinaria" of New Grenada.*]

BOGOTA, *June* 6, 1836.

Decree granting a privilege for an intermarine communication through the isthmus of Panama.

The Senate and House of Representatives of New Grenada in Congress assembled, having considered the propositions made by a number of individuals offering to undertake the construction of a road with iron bars, or a McAdamized road, from Panama to the environs of Cruces, and the establisment of a navigation of the river Chagres, with vessels propelled by steam or some other mechanical or animal agent or power; and considering—

1. That such a project promises great benefits to the nation, from

* The original was not received at the Department of State.

the impulse which it will give to the commerce and agriculture of many of the provinces of Grenada, by the exportation of their fruits and manufactured merchandise by way of the isthmus of Panama, without the delays and heavy costs now unavoidably incurred:

2. That when this undertaking will be completed, it will increase the value of the waste lands, and of all other kinds of property, public and private, by augmenting the population, and consequently their consumption: Do decree—

Art. 1. An exclusive privilege for opening an intermarine communication through the isthmus of Panama is granted to that person or those individuals, citizens or foreigners, who shall propose the greatest advantages to New Grenada, under the conditions set forth in the following articles.

Art. 2. An exclusive privilege for navigating the river Chagres in vessels or boats propelled by steam, or other artificial means, is given to the undertaker or undertakers, for the term of forty-five years at the utmost.

Paragraph 1st. The privilege referred to in this article is declared to be void, in case Charles, Baron of Thierry, or any legal representative of his rights, should complete the canal alluded to in the decree of May 29, 1835.

Paragraph 2d. This privilege shall not prevent the travelling upon the said river of canoes, *piraguas*, or other smaller craft, belonging to citizens of Grenada; which, however, are prohibited from carrying passengers and all kinds of merchandise, whether the same be designed for exportation or home consumption.

Art. 3. An exclusive privilege is also granted to the person or persons undertaking the construction of a road with iron rails, or a road upon the McAdam system, from the head of navigation of the river Chagres to the city of Panama; and, as a consequence, the transportation of cargoes upon the said road shall be solely carried on in the cars or other vehicles of the person or persons undertaking the enterprise, during the above mentioned period of forty-five years.

Paragraph. This grant shall not in any way impair the right of travellers to perform their journeys on horseback upon so much of the said road as to them may seem proper, and to forward their baggage upon mules or other beasts of burden.

Art. 4. Seventy-two thousand *fanegadas* of unoccupied lands are granted to the person or persons undertaking this enterprise, in order that they may procure fuel, establish posts for repairing, places for discharging, and stores for receiving the merchandise; form stables, post-houses, and other necessary objects; but the expenses of surveying, and the costs for the titles of property to be given by the authorities of Grenada, shall be borne by the grantee or grantees. This grant shall become null, if the undertaker or undertakers do not comply with the conditions stipulated in this grant.

Art. 5. Any land, the property of a private individual, which may be situated on the side of the road, may be occupied by the undertaker or undertakers, if this should be deemed necessary by

the governor of the province of Panama; a just indemnity having been first adjusted in conformity with the law of 31st July, 1823. Furthermore: if the undertaker or undertakers should wish to purchase any buildings belonging to the State, which are not under occupation for national purposes, and which may be situated on the isthmus of Panama, the same shall be sold to them, in conformity with the legislative decree of 6th June, 1835.

ART. 6. The republic binds herself to sell to the undertaker or undertakers to the amount of three hundred and sixty thousand fanegadas of land, upon the terms and under the conditions herein set forth:

1st. The undertaker or undertakers shall designate to the executive power, within the term of five years from the date of the execution of this decree, the situation of the lands in which they will select the said *fanegadas*, with this proviso: that they shall not designate any lands occupied, or which, in the opinion of the government may be necesary for the defence of the country.

2d. No more than one hundred thousand fanegadas shall be selected in any one of the maritime provinces containing navigable rivers within their limits; and the remainder of the said number of fanegadas shall not be selected in a greater proportion than one hundred and twenty thousand fanegadas in each one of the interior or central provinces.

3d. That, in the lands referred to in this article, none shall be comprised, the purchase of which has been offered to government.

ART. 7. The undertaker or undertakers shall pay for each fanegada a sum not exceeding one dollar, or eight reals, in lawful silver money, or in certificates of the interior or exterior consolidated debt, for their nominal value; but if, upon the day on which, in conformity with this decree, the undertaker or undertakers must open the free communication between the Atlantic and Pacific oceans, the conditions set forth in article 14 should not be fulfilled, then he or they shall restore the lands, in whatever situation the same may be, and the government shall restore to him or them the sums of money or obligations which he or they may have given for the same.

Paragraph. The costs of surveying and for the titles of property shall be borne by the undertaker or undertakers.

ART. 8. Settlements of foreigners may be made, as well upon the lands granted to the undertaker or undertakers, as on those which he or they may purchase, according to the conditions heretofore in this decree set forth; which shall not, for the term of twenty years, be subject to pay any national taxes, including tithes and firstfruits upon their farms or the consumption of their produce; nor shall they, during the said period, be called upon to serve in the army, except in the case of a foreign invasion.

Paragraph. The strangers, by whom the settlements referred to in this article shall be established, shall not be slaves or emancipated persons, and they shall take out their letters of naturalization within six months from the day on which they shall fix their residence upon such part of the republic as they shall have selected

for that purpose; and if this be not complied with, they shall not be considered as settlers.

Art. 9. The undertaker or undertakers are permitted, pending the duration of the hereby granted privilege, to establish a line of steamboats, as packet boats, between Panama or Chagres, or both, and any other ports of the republic or foreign ports: provided the said vessels be national, and be in operation within four years.

Art. 10. Epistolary correspondence and public papers passing over the isthmus shall not be subject to the post office regulations of New Grenada, nor to the postages therein imposed, provided they be upon the way from one foreign country to another, in the vehicles of the undertaker or undertakers.

Art. 11. In time of peace, no passports shall be exacted by the authorities of the isthmus from travellers passing from one ocean to the other; and the said authorities shall merely take a note of the number of passengers, and of their places of departure and destination.

Art. 12. All articles and specie destined for the navigation of the river Chagres, and the construction of the road, and the works indispensable to its proper operation, shall be introduced into the isthmus free of all duties.

Art. 13. An equal or similar freedom, and an exemption from all kinds of local taxes, are extended to the articles and merchandise which cross the isthmus (being intended for foreign countries) upon the means of communication contracted for in this privilege, during the term that the same shall be possessed by the undertaker or undertakers.

Art. 14. Upon the establishment of the navigation of the river Chagres, the completion of the road referred to, and the acknowledgement of this by the governor of the province, in compliance with the 12th and subsequent articles of the law of the 31st of July, 1823, of which he shall notify the executive authority, and the law of the 25th of May, 1835, which grants a free commerce to the cantons of Porto Bello and Panama, upon observance of the following conditions, shall be in full force and virtue:

1st. The undertaker or undertakers shall effect the necessary improvements in the river Chagres, in order that its navigation may offer proper security.

2d. That at least two steamboats shall be kept constantly upon the said river for the transportation of merchandise and passengers.

3d. That at all times, except in cases of accident, both communications shall be preserved in a state to allow the passage from one sea to the other, upon them, in fourteen hours, and the transportation of two thousand quintals in each day.

Art. 15. The undertaker or undertakers may commence water and road communications within the space of three years from and after the date of this decree, or sooner, if they deem it convenient so to do; and they shall be bound to conclude them within three years of their commencement.

Art. 16. They shall determine the rates of passage and freight to be demanded for the transportation of passengers and merchan-

dise over the isthmus in the vessels and cars of the undertaker or undertakers; they also are hereby empowered to alter them each year, according to circumstances, giving notice of such changes to the executive authority. The said rates shall be the same for the persons and cargoes of all nations of the earth.

Paragraph. Whatever may be the rates fixed upon, persons passing or travelling in the service of the republic, in the vehicles of the undertaker or undertakers, the troops and property of the State travelling across the isthmus in such vehicles, in any season of the year, shall only be liable to pay the one-third part thereof.

ART. 17. The undertaker or undertakers shall pay to the republic at least two per centum upon the net proceeds annually divisible among the stockholders, and this sum shall be applied to the exterior Colombian debt, so far as this relates to New Grenada:

ART. 18. On the expiration of the term of forty-five years from and after the conclusion of the work, the undertaker or undertakers shall deliver up to the republic, in good order, the two communications between the oceans, and they shall also be obliged to restore to the government that portion of the seventy-two thousand fanegadas of land which the government shall think necessary for the objects set forth in article 4.

ART. 19. In case the undertaker or undertakers should not comply with any one of the conditions contained in articles 14 and 15, they will, by the very act, forfeit this privilege; and they shall furthermore incur a fine of twenty-five thousand dollars, to be applied according to law. Security for such sum shall be given, satisfactorily to the executive authority, upon unincumbered property, exceeding in value the aforementioned sum of twenty-five thousand dollars by at least the one-third part thereof.

ART. 20. The transportation over the isthmus of the subjects of any nation at war with New Grenada is prohibited.

ART. 21. The republic binds itself, in the most solemn manner, not to grant upon the isthmus privileges similar to those given in articles two and three; and furthermore, to protect inviolate all the rights acquired by virtue of this decree, until the expiration of the said term of forty-five years hereinbefore stipulated.

ART. 22. This privilege shall not be assigned, transferred, or alienated to any foreign government; and all disputes arising upon or under it shall be determined by the authorities of the republic, and in conformity with the laws of the country.

ART. 23. The privileges granted by this decree shall be the maximum of those which the executive authority may grant to the undertaker or undertakers; and that authority shall adjudge the privileges set forth in this decree, on the expiration of fifteen days from its sanction. Within the said term he shall consider the proposals addressed to him, in order to decide upon a preference of the terms of some of them—these being the only conditions which may be improved, and there being no necessity for taking any other guaranty than that mentioned in article 19. And the undertaker or undertakers shall bind themselves to pay a fine of five thousand dollars, if they should solicit any prorogation previous or

subsequent to the expiration of the terms hereinbefore specified for the commencement and conclusion of the work, unless the river Chagres be made navigable for steamboats, and the one-half of the iron railroad or McAdamized road be finished.

Any proposals directed to the executive authority, without the requisites demanded in this decree, shall be returned to the parties therein interested, and shall be considered as not having been submitted prior to the decision or adjudication.

VALENTINE FROEZ,
President of the Senate.
JUAN CLIMACO ORDOÑEZ,
President of the House of Representatives.
FRANCISCO DE P. TORRES,
Secretary of the Senate.
PASTOR OSPINA,
Dep. Sec. House of Reps.

Bogota, *May* 29, 1836.

Bogota, *June* 6, 1836.

Let the above be decreed and published:
FRANCISCO DE PAULA SANTANDER.

By his excellency the President of the Republic:
LINO DE POMBO,
Secretary of Interior and Exterior Relations.

Decree of the executive authority adjudicating the privilege for opening an intermarine communication through the isthmus of Panama.

[Translation.]

Francisco de Paula Santander, *President of New Grenada:*

Whereas Charles Biddle, a citizen of the United States, in his own name, and in the names of such individuals as he may associate with himself in that republic, of the one part; and Vicente Azuero, Francisco Montoya, Diego Davison, Joaquin Orrantia, Raimundo Santamaria, General Jose Hilario Lopez, Joaquin Escobar, Juan Manuel Carrasquilla, Ignacio Morales, Pedro Ignacio Balderrama, Diego Fernando Gomez, Alejandro McDowell, Jose de Obaldia, and Miguel Saturnino Uribe, citizens and inhabitants of New Grenada, of the other part; yesterday jointly presented themselves to the executive authority, in the ordinary mode prescribed by law, soliciting the privilege which, by the legislative decree of the 6th of the present month, is granted in favor of an intermarine communication through the isthmus of Panama, and representing that they had formed an association for carrying that important enterprise into effect:

Whereas the said petitioners, in a memorial duly submitted to

me, bind themselves to undertake the enterprise referred to in the legislative decree dated the 6th of the present month, in its 2d and 3d articles, submitting themselves therefor to the conditions stipulated in its 14th, 15th, 18th, 19th, 22d, and 23d articles, demanding, by way of indemnity, the concessions set forth in the 4th, 5th, 6th, 7th, and 21st articles, which they accept, as well as the terms stipulated in the first, second, and third conditions of article 6th, in the paragraph of the 16th, and in the 17th article, together with those limiting the duration of this privilege to forty-five years, which extension only they solicit, and binding themselves for the punctual observance of all the provisions of the aforesaid legislative decree:

And finding the aforesaid proposals conformable to the said legislative act, and by virtue of the power reserved to me in its 23d article, with the prior assent of the government council, I do decree thus:

Art. 1. The privilege for an intermarine communication over the isthmus of Panama, which is granted to the undertakers of the enterprise by the legislative decree of the 6th of the present month, is adjudicated in the fullest manner, according to the liberal tenor of the said legislative act, to the association formed by Charles Biddle, a citizen of the United States, in his own name, and in the names of those in that republic who may associate themselves with him, on the one hand, and on the other hand Vicente Azuero, Francisco Montoya, Diego Davison, Joaquin Orrantia, Raimundo Santamaria, General Jose Hilario Lopez, Joaquin Escobar, Juan Manuel Carrasquilla, Ignacio Morales, Pedro Ignacio Balderrama, Diego Fernando Gomez, Alejandro McDowell, Jose de Obaldia, and Miguel S. Uribe, citizens and inhabitants of New Grenada.

Art. 2. Before the said association shall enter into the enjoyment of the privilege granted by the Congress of Grenada, and which has been adjudicated to them, they must fulfil the formalities prescribed in the 7th article of the executive decree made in furtherance of the legislative order on the 6th of this month, to wit: to tender within three days the writings of obligation, in which the legislative decree of the privilege, and the present order of adjudication, shall be recited word for word; also, to enter within thirty days, to the satisfaction of the executive authority, the above mentioned security for the fine of twenty-five thousand dollars, in the mode and under the circumstances specified in the 19th article of the legislative decree of privilege; furthermore, to enter security, in conformity with the practice and laws followed in the cases of the execution of all legislative privileges, for the fine of five thousand dollars, to which the undertakers will be made liable in the case suggested in article 23d; proceeding in the whole in compliance with the instrument granting the privilege.

Art. 3. The acceptance of the documents alluded to in the preceding article, being necessarily by the executive authority, shall be certified under the hand of the Secretary of State for the Department of the Interior and Exterior Relations, to whom the execution of this decree is confided, which he will communicate to

whom it may concern, together with a notice of the hour at which this was executed.

Bogota, *June* 22, 1836.

FRANCISCO DE PAULA SANTANDER.

By His Excellency the President of the Republic:

LINO DE POMBO,

Secretary of Interior and Exterior Relations.

H.

Bogota, *June* 28, 1836.

Colonel: I have been much gratified with the perusal of your esteemed favor, finding that you have not the least cause of complaint against the government of Grenada, in regard to the important question of granting a privilege for opening an intermarine communication through the isthmus of Darien. I have been active in this matter, animated with a desire of promoting the general interests of New Grenada, together with those of the isthmus provinces; and my satisfaction is increased to a very high degree by a very confident assurance that the undertaking will be completed. I have seen the interests of my fellow countrymen identified with those of the northern parts of our continent, and thus my sympathies for the United States have been gratified. I have in this manner made some return for those good wishes which have induced me to express the most grateful acknowledgments for the reception which I there met with in times less propitious for me than the present.

May Heaven crown your efforts in the enterprise which you have unkertaken, and lavishly shower its benefits upon your countrymen and my own.

Accept the sentiments of consideration with which I subscribe myself, your very obedient servant,

F. P. SANTANDER.

Colonel Charles Biddle.

I.

Bogota, *June* 28, 1836.

Our much esteemed Sir and Friend: We have the pleasure of replying to your valedictory letter, which you were pleased to address to us, under circumstances peculiarly sad to ourselves; rejoicing, however, in the happy termination of the important negotiation conducted by you for the establishment of a free communication over the Isthmus of Panama, whereby the commerce of the North and South American republics will be extended, the tardy intercourse between the old and new worlds quickened, and a life

and wealth be imparted to the almost annihilated provinces of that region.

Great were the difficulties which intervened before the concession was obtained; moments have passed at which a complete overthrow seemed impending over the efforts which were being exerted with a view to obtain immense advantages to the commerce of the world, and particularly to the United States and New Grenada, the mercantile relations of which two countries must bind themselves from day to day, until they shall become uni ed as brothers, since such they are by nature. But it was written in the book of fate that the isthmus of Darien, celebrated for its geographical position since first the fleet of Spain discovered the Columbian hemisphere, should no longer remain an obscure spot; that its ports should no longer, like the deserts, be lost to the commerce of nations; and, finally, it was decreed that the *freest people on earth* should undertake accomplishing that metamorphosis which will place the isthmus amongst the foremost of contemporaneous nations.

If our services have contributed to the fortunate termination of the law for granting this privilege, it was but just that they should be exerted in our capacity of deputies from Grenada, since we thereby fulfilled our duties, and complied with our oaths. We, therefore, have not the right to receive the praises which you have heaped upon us for our feeble services consecrated to our country. On the other hand, you merit our eulogiums for the prudent and skilful conduct which you have pursued, for your indefatigable zeal, and for the honorable manner in which you have adhered to your novel and solemn engagements with the Grenada association; engagements which shall never be violated by either party, and which aim at the completion of the grandest undertaking hitherto registered in the annals of South America.

We wish you a speedy and agreeable passage to your native country, and trust that your return to the theatre of operations of this united company may be as prompt and fortunate as your devoted servants and sincere friends can possibly wish.

B. AROSSEMENA,
JOSE DE OBALDIA,
In their own names, and in the names of their absent colleagues,
GERONIMO GARCIA, and
ESCOLASTICO ROMERO.

Colonel CHARLES BIDDLE.

K.

BOGOTA *June* 28, 1836.

RESPECTED SIR: Since Mr. Azuero, and his coadjutors in the association formed at this capital for the purpose of obtaining a charter to open an intermarine communication through the isthmus of Panama, had the pleasure of acting in concert with you in that enterprise, they have experienced the most ardent desire to

furnish you with unequivocal proof of the sincerity with which they feel themselves allied to you, not only in interests, but also in the bonds of friendship. The company trust that time will furnish an opportunity for testifying their sentiments towards you upon this subject; and in the meanwhile we solicit, in their name, that you will be pleased to accept, as a slight token, a banquet, which, by their instructions, has been prepared in your honor for the 30th of this month, at number 25 in the street of the "Universidad Antigua."

We have the honor of subscribing ourselves your most obedient, humble servants,

A. McDOWALL,
JOAQUIN ORRANTIA,
IGNACIO MORALES,
Committee.

Colonel CHARLES BIDDLE.

L.

LEGATION OF THE UNITED STATES,
Bogota, June 24, 1836.

SIR: It gives me great pleasure to be able to congratulate you upon your final success and completion of a contract for the privilege of constructing a road across the isthmus of Panama, with the government of New Grenada. This great and enterprising work must eventually be of immense importance to the commerce of the United States, as well as become "the highway of nations," and give a new direction to the commerce of the world.

The many embarrassing circumstances which you have had to encounter can only be appreciated by those who have witnessed them; and you may rest assured that, to the extent of my official duties, I will continue to render you every aid in my power, by cultivating the most friendly relations with this government, that you may be enabled to progress with a work so useful to our merchants, and so advantageous to the republics of North and South America.

You will please to accept this as a testimonial of your patriotic exertions, with my best wishes for the success of the undertaking.

With sentiments of high respect, I am your obedient servant,
ROBERT B. McAFEE.

Colonel CHARLES BIDDLE.

M.

BOGOTA, *May* 10, 1836.

ESTEEMED SIR: I have just received your favor of yesterday, and proceed without any delay to answer the three questions pro-

posed in it, as well from my desire of gratifying you, as from the circumstance of my being on the eve of my departure for the country.

1st. From the slight and imperfect knowledge which I possess in relation to the isthmus of Panama, the project of opening a canal for the passage of heavy vessels from one ocean to the other appears to me a chimera. I am certain that this is impracticable to the north of Panama. Further to the south, principally in the regions held by the savages of Darien, we perceive, by the mere inspection of some ancient maps, that there are greater facilities for a water communication between the Atlantic and Pacific oceans; but, as I possess no exact knowledge of the topography of the intermediate country, or of its elevation above the level of either ocean, I can give you no positive information on this head. I am firmly of opinion that, in the present condition of the civilized world, the opening of a canal for vessels of a heavy tonnage is a chimera; and that if it be possible to put the plan into execution for vessels of a lighter draught, this must be done to the south of Panama, and cannot be accomplished until the gradual improvement of the isthmus will furnish the means of acquiring more correct geographical and topographical knowledge of that entire country than is now at our command.

2. The Chagres appears to me to be navigable for steam vessels constructed expressly for that river; care being, of course, taken to avoid those inconveniences which have been observed to exist upon the Magdalena, consequent upon the want of judgment of the persons who directed the enterprise.

3. The country between Cruces and Panama is of firm bottom; the range of the Andes passing over it is low, without precipices, and easily travelled over. Why, then, could not an excellent road be constructed here?

I salute you very cordially; your obedient servant,

P. GUAL.

Colonel CHARLES BIDDLE.

Mr. Forsyth to Mr. Biddle.

DEPARTMENT OF STATE,
Washington, December 5, 1836.

SIR: It does not appear, from any of the communications received from you, that you have made any attempt to comply with that part of your instructions relative to a connexion of the Atlantic with the Pacific ocean, by means of the river San Juan and Lake Nicaragua. As the time that has elapsed since your departure from Washington has been ample for you to have fulfilled all the purposes of your errand, it is presumed that some of your letters containing the information desired, or explaining why it has not been obtained, may have miscarried. A list of those received is subjoined. If it

should appear that any you have written are missing, you will transmit duplicates of them to the department.

I have the honor to be, sir, your obedient servant,

JOHN FORSYTH.

CHARLES BIDDLE, Esq., *Washington.*

Letters.

Letters from Havana.
Kingston, Jamaica, 8th and 13th November, 1835;
Panama, 7th, 16th, and 29th December, 1835;
Panama, 18th January, 1836;
Bogota, 15th and 24th March, 1836;
Philadelphia, 25th September, 1836;
and a letter, without date, received 15th November, 1836.

Mr. Hopkinson to Mr. Forsyth.

PHILADELPHIA, *December* 21, 1836.

SIR: The enclosed letter was written on the 14th instant, by me, from the dictation of my brother-in-law, Colonel Charles Biddle. He was too unwell to write himself.

From that time till his death, which took place this morning, Mr. Biddle has not been well enough to sign it, and it was found among his papers unsigned. I have thought it proper to forward it to you as it is. The copy of the letter referred to in it will be furnished from his letter book in the course of a few days.*

I have the honor to be, very respectfully, your obedient servant,

FRANCIS HOPKINSON.

Hon. JOHN FORSYTH,
Secretary of State.

Mr. Biddle to Mr. Forsyth.

PHILADELPHIA, *December* 14, 1836.

SIR: Upon entering the railroad car from Washington to Baltimore, your letter was handed to me, which contains an inquiry as to the cause why I had not visited Central America.

The reasons are twofold. I had ascertained from the most authentic sources in Cuba, Jamaica, and New Grenada, that the pro-

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*The letter here referred to has never been received at the Department of State.

ject of a communication between the Atlantic and Pacific oceans, by the San Juan river and lake Nicaragua, was utterly impracticable. In the second place, the intercourse between the United States and the mouth of the San Juan river was such as to render it impracticable to arrive at that port without chartering a vessel for the express purpose.

You will probably recollect that, in my conversation with you in May, 1835, I suggested to you the propriety of appropriating a public ship for the purpose of accomplishing my mission. The reasons for declining it you will also recollect.

In order even to reach the nearest point of my designation, [destination,] I was compelled to accept the courtesy of Admiral Pell, of his Britannic majesty's navy.

As a further evidence of the difficulties of communication between the United States and South America, I refer you to the annexed copy of my *private* letter to General Jackson, written in Panama in December last.

I have the honor to be, very respectfully, your obedient servant,

[Not signed.]

Hon JOHN FORSYTH,
Secretary of State, City of Washington.

Extract of a letter from Mr. McAfee to Mr. Forsyth dated

BOGOTA, *December* 9, 1836.

On the 8th instant I received your despatches Nos. 33 and 34, and you may judge of my surprise that anything in my correspondence as to the *Panama* road could be construed into an interference, on the part of the government of the United States, in Colonel Biddle's project. My letter introducing Colonel Biddle was an act of courtesy, and *required* by this goverment. His appointment and business were explained by your letter, and Mr. Pombo was informed *explicitly* that the government of the United States had no interest or concern in the business, beyond the mere consent to Colonel Biddle's wishes upon the subject; and, to prevent any misunderstanding, a copy of your letter to him was given to Mr. Pombo. Colonel Biddle knew all this, and should have so explained to you.

Extract of a letter from Mr. McAfee to Mr. Forsyth, dated

BOGOTA, *December* 9, 1836.

SIR: Agreeably to your instructions in your despatch No. 33, I immediately on its reception addresed a note to the Secretary of Foreign Affairs, a copy of which is annexed; and I hope will place the subject in a proper point of view, and remove any mistakes which have unfortunately been made. I was in great hopes that I

would have obtained an answer in time to send with this despatch; but yesterday being a *feast day*, no business could be done; and a *private* note this moment received from Mr. Pombo, informs me that he cannot see the President in time for the mail.

I called in person on the Secretary, when I delivered my note, and his recollections of my statements accord with mine, and he observed that he had made a similar statement before Congress. I told him that I very much regretted that my note of the 17th March last conveyed any idea that I was instructed to aid Colonel Biddle in any measures further than the *special duties* assigned to him, *which were stated in my letter, as well as in his appointment.* He then observed that he did not understand from me that the government of the United States was interested in the matter, as I had afterwards disclaimed any *official* authority to act. What the President may say, I do not know; when the answer is received, I hope it will exempt me from any censure here, as I am conscious I do not deserve it.

Mr. McAfee to Mr. Pombo.

LEGATION OF THE UNITED STATES,
Bogota, December 8, 1836.

SIR: The undersigned, chargé d'affaires of the United States, has the honor to inform your excellency that he has received a despatch from his government, in which an impression has been made that the government of the United States was interested in the project of Colonel Biddle to construct a road across the isthmus of Panama, and that this may be inferred from the correspondence of the undersigned with your excellency in introducing Colonel Biddle's propositions to the government of New Grenada. This inference has truly surprised the undersigned, and will be equally surprising to your excellency, as a copy of Colonel Biddle's special agency was handed to you at the time of his introduction; and the undersigned uniformly stated that the government of the United States had no interest in the business whatever, and he is satisfied that this government so understood the subject.

That there may be no misunderstanding in regard to this matter, the undersigned is instructed by his government to say that the project of Colonel Biddle was entirely *his own private concern*, and wholly without the authority of the government of the United States, other than a mere willingness that Colonel Biddle, or any of its citizens, should enter into a contract with the government of New Grenada; and that, so far as the authority of Colonel Biddle extended, in relation to the government of the United States, it was "to obtain information for the purpose of enabling the President of the United States to judge of the practicability and utility of a railroad or canal across the isthmus of Panama; upon which points he has as yet formed no opinion."

The undersigned being satisfied that the impression made upon

his government in relation to this matter is erroneous, and that the whole subject was well understood by your excellency as a private contract on the part of Colonel Biddle, he requests the views of your excellency in relation to this matter; and, in case a different opinion is entertained, the undersigned is instructed to disclaim all participation or concern in the business on the part of the government of the United States; and that any inference which may be drawn as conveying any such opinion in the correspondence of the undersigned is disapproved.

The answer of your excellency is requested at the earliest convenient moment.

With renewed sentiments of high respect, the undersigned is your excellency's obedient servant,

ROBERT B. McAFEE.

His Excellency LINO DE POMBO, *Minister, &c.*

Mr. McAfee to Mr. Forsyth.

LEGATION OF THE UNITED STATES,
Bogota, December 16, 1836.

SIR: I now have the pleasure of enclosing to you the answer of Mr. Pombo, Secretary of Foreign Relations, to my note of the 8th instant; in which you will find, so far from interfering *officially*, or compromitting the *authority* of the government of the United States in the case of Colonel Biddle's *Panama* road, that directly the reverse was the fact. This government was expressly informed by me that *I had no authority* to interfere or take any official part in his propositions; and a copy of your letter appointing Colonel Biddle *a special agent to collect statistical information, and examine into the practicability and utility of a railroad or canal across the isthmus of Panama*, was handed by me to Mr. Pombo when Colonel Biddle was introduced; so that no misunderstanding did or could take place on the subject. It is true I was friendly to Colonel Biddle's project *individually*, as a great work, beneficial to the commerce of the world. But it was well understood by this government, and in Congress, that the government of the United States had no participation in the same, either directly or indirectly; and on this account, and lest suspicions might be excited, I abstained from attending Congress during the debates on the subject. I am very desirous that the President and yourself should know the *truth*, (which I hope to be able to give you when I return,) which I am confident will satisfy you that I have in no instance either compromitted my government, or misrepresented it to this; and I am happy to believe that there never has been a moment of dissatisfaction or unpleasant feelings *on my account;* but at this time, and ever since I have been here, the most cordial friendship and good understanding has prevailed between myself and every branch of the government. I have at all times labored *to obtain* and *give* you correct information; and, upon a review of

my *official* and private correspondence, I have no reason to charge myself with a neglect of duy, or to have expected, *in this affair especially*, to have had my course *disapproved so strongly*, when I had discharged my duty so fully. In my despatch of the 30th of June, I stated the facts as to Colonel Biddle's contract *as a matter of information*, and not as an *official transaction* on my part, or that of the government of the United States. This much, justice to myself required that I should say *at present;* reserving a more detailed account at a future day, when I can personally correct the erroneous information which you have *very probably* received in relation to this matter, and the part I took in it, as I do not believe that either you or the President would do me intentional injustice.

With sentiments of high respect, I am your obedient servant,

ROBERT B. McAFEE.

Hon. JOHN FORSYTH, *Secretary of State.*

Mr. Pombo to Mr. McAfee.

[Translation.]

DEPARTMENT OF THE INTERIOR AND FOREIGN RELATIONS,
REPUBLIC OF NEW GRENADA,
Bogota, December 10, 1836.

The undersigned, Secretary of State for the Department of the Interior and Foreign Relations, has the honor to acknowle'ge the receipt of the note which the chargé d'affaires of the United States was pleased to address to him on the 8th instant, communicating that he had received a despatch from his government, ordering him to state to that of New Grenada that it had no part, direct or indirect, in the propositions made by Colonel Charles Biddle for opening a communication between the two seas, across the isthmus of Panama, in case such should be the supposition of the Grenadian government.

The undersigned has the satisfaction to state, in reply to the chargé d'affaires, by order of the President, that the government of New Grenada has had no rational grounds afforded by the documents in this department for supposing that the government of the United States took any other official measures in the matter in question than to recommend Colonel Biddle personally; and that it could not have been otherwise, inasmuch as the propositions of that gentleman were, from the commencement, made in the character of a private contractor; at least, such appears to be the inference from the contents of the notes from the chargé d'affaires, dated 17th March and 24th of May last, and from the conduct of Mr. McAfee, which has ever been perfectly frank.

Moreover, whatever may have been the opinion of the government of New Grenada, it is now entirely convinced and satisfied,

by the solemn assurances of Mr. McAfee on this subject, made in the name of the government of the United States.

The undersigned repeats to the chargé d'affaires the assurance of his distinguished consideration, and remains his obedient servant,

LINO DE POMBO.

To the Hon. R. B. McAfee,
Charge d'affaires of the United States.

Extract of a letter from Mr. Forsyth to Mr. McAffee.

Department of State,
Washington, February 18, 1837.

Sir: Your despatches to No. 40, inclusive, have been received.

The explanation you give on the subject of your intercourse with the Grenadian government, in relation to Mr. Biddle, is entirely satisfactory. If the department had been more fully informed of your proceedings, there would have been no occasion to address you the instructions of the 23d of September last. From your despatch No. 34, however, and the correspondence which accompanied it, no other inference could be drawn than that you had mistaken both the intention of the department, in directing you to forward the purposes of Mr. Biddle's errand, as well as the objects for which he was sent.

Robert B. McAfee, Esq.,
Charge d'affaires of the United States, Bogota.

Extract from the letter of instructions given by Mr. Clay, as Secretary of State, under the direction of President Adams, to the ministers of the United States commissioned to the congress or meeting of ministers of different nations held at Panama in the year 1826.

"A cut or canal for purposes of navigation, somewhere through the isthmus that connects the two Americas, to unite the Pacific and Atlantic oceans, will form a proper subject of consideration at the congress. That vast object, if it should ever be accomplished, will be interesting, in a greater or less degree, to all parts of the world. But to this continent will probably accrue the greatest amount of benefit from its execution; and to Colombia, Mexico, the Central Republic, Peru, and the United States, more than to any other of the American nations. What is to redound to the advantage of all America, should be effected by common means and united exertions, and should not be left to the separate and unassisted efforts of any one power.

"In the present limited state of our information as to the practicability and probable expense of the object, it would not be wise to do more than to make some preliminary arrangements. The best

routes will be most likely found in the territory of Mexico, or that of the Central Republic. The latter republic made to this government on the 8th of February of last year, (1825,) in a note* which Mr. Cañaz, its minister here, addressed to this department, (a copy of which is now furnished,) a liberal offer, manifesting a high and honorable confidence in the United States. The answer which the President instructed me to give (of which a copy† is also now placed in your hands) could go no further than to make suitable acknowledgments for the overture, and to assure the Central Republic that measures would be adopted to place the United States in the possession of the information necessary to enlighten their judgment. If the work should ever be executed so as to admit of the passage of sea-vessels from ocean to ocean, the benefits of it ought not to be exclusively appropriated to any one nation, but should be extended to all parts of the globe, upon the payment of a just compensation or reasonable tolls. What is most desirable at present is, to possess the data necessary to form a correct judgment of the practicability and the probable expense of the undertaking on the routes which offer the greatest facilities. Measures may have been already executed, or be in progress, to acquire the requisite knowledge.

"You will inquire particularly as to what has been done, or may have been designed, by Spain, or by either of the new States, and obtain all other information that may be within your reach to solve this interesting problem. You will state to the ministers of the other American powers that the government of the United States takes a lively interest in the execution of the work, and will see with peculiar satisfaction that it lies within the compass of reasonable human efforts. Their proximity and local information render them more competent than the United States are at this time to estimate the difficulties to be overcome. You will receive and transmit to this government any proposals that may be made, or plans that may be suggested for its joint execution, with assurances that they will be attentively examined with an earnest desire to reconcile the interests and views of all the American nations."

Extracts from Mr. Jefferson's correspondence with Mr. Carmichael in 1787, 1788, and 1789, relating to a survey of the isthmus by the Spanish government.

From Thomas Jefferson to William Carmichael.—[Extract, at the conclusion.]

PARIS, *December* 11, 1787.

I have been told that cutting through the isthmus of Panama, which the world has so often wished and supposed practicable, has at times been thought of by the government of Spain, and that they once proceeded so far as to have a survey and examination

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* Vide p. 215 of this report. † Vide p. 246, ib.

made of the ground; but that the result was either impracticability or too great difficulty. Probably the Count de Campomanes or Don Ulloa can give you information on this head. I should be exceedingly pleased to get as minute details on it as possible, and even copies of the survey, report, &c., if they could be obtained at a moderate expense. I take the liberty of asking your assistance in this.

I have the honor to be, &c.,

TH. JEFFERSON.

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From the same to the same.

PARIS, *May* 27, 1788.

With respect to the isthmus of Panama, I am assured by Burgoin (who would not chose to be named, however) that a survey was made—that a canal appeared very practicable; and that the idea was suppressed for political reasons altogether. He has seen and minutely examined the report. *This report is to me a vast desideratum, for reasons political and philosophical.*

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From the same to the same.

PARIS, *May* 8, 1789.

DEAR SIR: Your favor of January 26 to March 27 is duly received, and I thank you for the interesting papers it contained. The answer of Don Ulloa, however, on the subject of the canal through the American isthmus, was not among them, though mentioned to be so. If you have omitted it through accident, I shall thank you for it on some future occasion, as I wish much to understand that subject thoroughly.

Description of the Caledonian canal, taken from Lieber's Encyclopædia Americana, vol. 2, page 455.

This stupendous canal passes through a chain of lakes or lochs and narrow arms of the sea; and by making 21⅞ miles of canal, and deepening the beds of the rivers Lochy and Oich, and dredging to deepen a part of Loch Ness, (in the whole a distance of 4½ miles, making the total length of excavation 25 miles, with a lockage up and down of 190 feet,) an interior navigation of 250 miles is opened across the central part of Scotland, from the Murray Firth, on the eastern coast, to Cantyre, on the western, and about opposite to the northern coast of Ireland; being one-half the distance of the navigation between the same extreme points round the northern coast by the Orkneys. It has twenty-seven locks, including the tide locks, one of them 170, but most if not all the others 180 feet long, and all forty feet wide; thus opening a ship navigation

hrough the midst of the country, rising at the summit level 94 feet bove the tide water of the eastern coast, and 96½ feet above that f the western, showing the ocean to be 2½ feet higher on the east- rn. At Fort Augustus, where it leaves Loch Ness in a northwest- rly direction, this canal is cut through the glacis of the fortifica- ion, thus adding to the military defences as well as to the appear- nce of the fort, which, with the five locks of masonry rising behind, presents a grand combination of civil and military engineering, amid romantic mountain scenery. From Loch Ness, passing in the westerly direction of the canal to Loch Oich, 1¾ mile, the land is twenty feet above the water line, which, with the depth of water in the canal, makes an excavation in this distance of forty feet in depth, with a bottom of forty feet in breadth. To save rock cut- ting, in descending in the westwardly direction as before, from Loch Oich to Loch Lochy, the natural difference of the surfaces of the two lakes being 22 feet, the whole area of Loch Lochy, which is ten miles in length and one in breadth, is raised twelve feet. In the last two miles, before the canal, in its westerly direction, en- ters Loch Eil, there is a descent of 64 feet, which is passed by eight connected locks, each 180 feet long by 40 in breadth. These locks are founded on inverted arches, exhibiting a solid and continuous mass of masonry, 500 yards in length and 20 yards wide, in which, as late as 1824, and five years after its construction, no flaw had been discovered. The gates are of cast iron. This system of locks has received the fanciful appellation of *Neptune's staircase;* and the appearance of large vessels, with their masts and rigging, de- scending these stupendous locks from the hill towards Loch Eil, is most majestic and imposing, exhibiting a striking instance of the triumph of art. In the distance of eight miles from Loch Lochy to tide water in Loch Eil, the canal, in passing along the north- westerly bank of the river Lochy, crosses, by aqueduct bridges, three large streams and twenty-three smaller ones. Since the con- struction of this canal, upwards of a million of forest trees have been planted along its borders.

The cost of this great national work, was—

Management and travelling expenses	£29,000
Timber	68,600
Machinery, cast iron work, &c.	121,400
Quarries and masonry	195,800
Shipping	11,000
Labor and workmanship	418,000
Houses and buildings	4,600
Purchase and damage of land	47,900
Horse labor	3,000
Road-making	4,000
Incidental expenses	2,000
	£905,300
Add to complete the dredging	7,200
	£912,500

Assuming the number of miles operated upon to be 25, the canal cost £36,500 per mile. It was constructed under the direction of Thomas Telford, esq.

N. B.—Finished in 1822; 21⅞ miles in length; 190.5 feet total ascent and descent—8.6 feet per mile; 40 feet breadth at bottom; 20 feet depth.

Description of the Amsterdam canal; taken from Lieber's Encyclopædia Americana, vol. 1. p. 222.

The new canal, [of Amsterdam,] extending from its harbor to the extreme point of North Holland, 26 feet in depth, is of great advantage to Amsterdam. It removes some of the chief impediments to the commerce of the city, viz: the necessity which existed of unloading large vessels before they could enter the harbor, and of encountering the passage through the Zuyder-zee, which was peculiarly difficult with contrary winds. The shipping of goods to and from Amsterdam will therefore be effected in future more promptly and cheaply. This canal extends from Amsterdam to Niewe Diep. The distance between the extreme points is 41 English miles, but the canal is about fifty miles and a half long; the breadth at the surface is 124½ English feet; the breadth at the bottom 36 feet, the depth 20 feet 9 inches. It passes through a somewhat marshy country, and touches, beside several villages, the cities of Purmerend and Alkmaar. Like the Dutch canals generally, its level is that of the high tides of the sea, from which it receives its supply of water. The only locks which it requires, of course, are two tide locks at its extremities; but there are also two sluices with flood-gates in the intermediate space. The locks and sluices are double—that is to say, there are two in the breadth of the canal. The canal is wide enough to admit of one frigate passing another. The time spent in tracking vessels from the Helder to Amsterdam is 18 hours.

Extract from Murray's Encyclopædia of Geography respecting Guatemala and Lake Nicaragua, page 1398.

Sec. 4.—Productive Industry—Guatemala.—No. 5,914

Canals are naturally an undertaking beyond the infant resources of Guatemala; but one is in contemplation which, if executed, will be the greatest and most important work of this kind on the globe. This is a canal to connect the Atlantic and Pacific, so as to enable European vessels to reach China and parts of India by an easier and more direct course. The isthmuses of Darien and Panama, from their very small breadth, naturally claim the first attention; but they have never been surveyed with any care; it is certain that

a considerable ridge traverses them, and the supply of water is doubtful. The isthmus of Tehuantepec, and the interval between the rivers Atrato and San Juan, in Choco, appear to be level; but the distance is too great to admit of more than a canal of small navigation, which would doubtless have its use. But the grand oceanic canal, which would cause a revolution in the commercial world, will probably be undertaken from the lake of Nicaragua, navigable for the largest vessels, which communicates with the Atlantic by the broad channel of the San Juan, and is separated from the Pacific by an interval of from sixteen to twenty miles in breadth, through which it seems certain that a good canal could be formed. To execute, therefore, a canal of the dimensions of the Caledonian is even at present completely within the reach of human skill and resources. It is an undertaking, indeed, which does not belong to the government within whose limits it is placed; and though the capitalists of Europe would find no difficulty in providing the funds, the political atmosphere of the west is scarcely yet so settled that they might look forward with full confidence for compensation for the large advances which would be necessary.

Remarks of the Marquis de Iceneri, of Guatemala, respecting the route for a canal by way of Lake Nicaragua.

[Translation.]

Brooklyn, *May* 8, 1836.

Having attentively perused a pamphlet entitled "A Project of Communication between the Atlantic and Pacific Oceans," I have perceived a very limited sketch of the advantages of the enterprise taken in general, rather than of the particular and secondary ones which the selection of a place for this great work may afford. Without on this account censuring the merits of the author, who has published his ideas on a subject of common interest to the human race, I will suggest some of the advantages which the point of Nicaragua offers, and which may yet obtain for it the preference for the opening of the canal.

Although the distance between the Atlantic and the Pacific, at this point, may be somewhat longer than at the isthmus of Panama, the land presents much fewer difficulties to overcome; because the great range of the Andes, which, in passing through Panama, rises many feet above the level of the ocean, is cut by nature at Nicaragua, where the surface of the country lying between this lake and the Pacific is almost level, and there is no high mountain requiring to be opened. All this country is exceedingly fertile, and suitable for the cultivation of tobacco, coffee, sugar, cocoa, indigo, rice, corn, cotton, and all the productions peculiar to the climates of the torrid zone. The climate, although hot, is healthy; and the value which the lands would acquire, as well as the fish of the lake, would be immense.

On the very banks of the lake the city of Grenada is situated, which at once offers a good residence for the directors of the enterprise. The lake is, as it were, made by nature to serve as a common port for all vessels; and at whatever point (as Grenada) the anchorage is fixed, a commercial city will rise, which will serve as a depot for all nations, and as a central place for the exchange of the many goods and productions which will naturally accumulate there.

The State of Nicaragua, in the bosom of which the lake is situated, presents a level and exceedingly fertile country, which can be crossed by railroads without any difficulty. On this great plain the best of timber abounds for the construction of houses, ships, furniture, &c. At the present day carriages can pass from the port of Realejo, on the Pacific, to the city of Grenada, on the banks of the lake.

The river San Juan issues from the lake, and empties into the Atlantic, and is navigable for canoes and for steamboats of light draught of water; but, with little expense and labor, the obstacles which now prevent the ascent of large steam-vessels could be overcome. All the iron necessary to commence the work could be carried up in a small steamboat to Grenada as a place of deposite.

Throughout the State of Nicaragua black cattle and horses abound. The former affords provisions for laborers, and the latter can be used for carriages when required. It is not necessary to introduce laborers who demand high wages, as the State can supply ten or twelve thousand workmen, at two or three reals a day, who only need just and humane treatment to be easily governed, and to perform punctually whatever may be required of them. In Panama there are few inhabitants; provisions are scarce and very dear, as are likewise cattle and horses.

The State of Nicaragua is bounded on one side by that of Costa Rica, and on the other by that of Honduras, in both of which there are mines of gold, silver, copper, iron, and lead; and, although very rich, they have not been worked with energy, for want of scientific knowledge and capital.

The canal once opened, the whole coast of Central America on the Pacific offers a vast field for great speculations and enterprises. It is a classical country, particularly favored by nature. As its elevation increases toward the interior, different climates and productions are met with; and nothing is more surprising than to see in the market of Guatemala, the capital of the whole country, at the same time, and at the very lowest prices, peaches, apples, pears, &c., pine apples, oranges, plantains, &c., all produced within a short distance, and even in the gardens of the city itself; where an orange tree may be seen bearing all the year leaves, blossoms, ripe and green fruit, and at its side an apple tree also loaded with fruit in its season; because exotic plants produce but one crop, with the exception of the vine, which produces two. The fruits natural to a temperate climate, like that of Guatemala, which never exceeds 75, or falls below 65 of Fahrenheit, are of the richest and most delicious kind; and in uninterrupted succes-

sion during the whole year are seen classes and varieties too great to enumerate. There, in the cultivation of vegetables, the season is not attended to; for there reigns a perpetual spring, and the garden may be visited any day of the year with the certainty of finding in it the most beautiful flowers and fruits.

In 1831 strawberries were introduced in the garden of a proprietor, with seed imported from the United States; and without any other labor than irrigating the plants in the dry season, they produced fruit the whole year, and multiplied prodigiously. In 1832, Dr. Leonard Perez, a Spaniard, and professor of botany, went from New York to Guatemala, and, having observed the country during a year, wrote me as follows: "Here there are no rules laid down in European writings that can be applied; for nature follows a different course, especially in the temperate climes, as in this city. Every thing here surprises me; nature is always at work; plants grow without ceasing. The multiflora you sent me is already 15 feet high, and I have never seen one more beautiful of the same age. When this country is more known and better explored, it will call the attention of the whole world. I seem to be in Paradise. I have not time to examine the variety of plants hitherto unknown to me." If the canal at Nicaragua should at any time be undertaken, all speculations in lands will be drawn to Central America; and that will be the most important country on the American continent, as well on account of its geographical situation, as for the advantages of an immense commerce, and the excellence of its productions. With so great a variety of climate, when that country shall be cultivated, it will present a miniature picture of the whole globe. But for the misfortune of remaining for three centuries subject to tyrannical and stupid government, like the Spanish, that country would now have been the emporium of riches and of civilization; but so long a period of slavery and impoverishment has kept it hidden from the eyes of other nations, who are even ignorant of its importance. During the fourteen last years, since the emancipation of Central America from the dominion of Spain, it has advanced very little, because the sudden change of political institutions has produced great confusion; and as an ignorant nation is unable to govern itself democratically, the Central Americans, in their apprenticeship to liberty, have experienced many revolutions; have fallen into many errors; and their governors, without practical knowledge in the art of governing, have gone on stumbling at every step against obstacles and difficulties which cannot be overcome when foresight is wanting. Finally, the country has been tranquilized, and the clamor of civil war is no longer heard; and I believe nothing would contribute more effectually to the establishment of order than the enterprise of the canal, which would occupy the attention of all the inhabitants, and, with the hope of a happy future, would keep them quiet.

A topographical account of the province and lake of Nicaragua, together with a brief sketch of the productions, climate, rivers, &c., of the republic of Guatemala.

The topographical situation of the province of Nicaragua is extremely favorable for commerce. On the north it is washed by the waters of the Atlantic, and on the south by those of the Pacific ocean. On both sides it possesses excellent ports, particularly that of San Juan to the northward, and that of Realejo to the southward; the anchorage is good, and vessels can ride in each of them in perfect security. They likewise present great facilities towards the building and careening of ships; also an abundance of timber, and other materials requisite for the construction of a navy on the most moderate terms; so much so, that this province finds itself favored with advantages sufficient to enable it to compete with the most prosperous and flourishing nations of the universe.

Its fertile soil abounds in the richest productions of the earth, particularly cocoa, indigo, cotton, sugar, cattle of various kinds, timber of manifold qualities, pitch-pines, pitch, tortoise shell, fine Brazil wood, sarsaparilla, balsam of balm, liquid amber, (*cativo*,) Indian corn, rice, kidney beans, cord grass, (*cabulla*,) the heart-leafed bixa, or annotta, (called in botany *bixa orellanæ*,) and various species of the date-palm tree; together with many other plants and shrubs highly susceptible of cultivation and improvement. In a word, nothing is wanting but a small capital to make the exportation thereof, and profits thereon, excessively beneficial to speculators in foreign markets.

A good wagon road facilitates the land communication from the Pacific to the city of Grenada; and the intercourse is kept up between the latter place and the Atlantic by way of the lake Nicaragua and the river San Juan.

In order to form a just conception of the resources and wealth of those provinces, it is not alone sufficient to consider the importance of the junction of the two seas; it should at the same time be considered that the extreme fertility of the soil, and the solid advantages they must reap from their productions, above all in minerals, are alone sufficient to raise them to the highest state of affluence and consequence. But, for the purpose of giving a clear and exact exposition thereof, we shall proceed to present a brief account of the most important points relating to the object in question.

In the *first* place, the fresh water lake Nicaragua is 150 leagues in circumference; parts of its shores are uninhabited; likewise all its islands, with the sole exception of Ometepec; its greatest depth being twenty fathoms, with sandy bottom; its extreme profundity all over is —— feet and a fraction. But, notwithstanding the inequality of its depth, vessels called *piraguas*, using sails, easily navigate the entire lake, and coast along its shores with the greatest facility; and it is not long since vessels of much larger burden ploughed its waters, (as, for instance, large vessels, brigs, schooners, and bilan-

ders,) and these armed, without ever experiencing any want of water. The elevation thereof exceeds that of the Pacific by about thirty cubits; however, this cannot be positively affirmed.

Don José Aranda, first constitutional alcalde, and late consul, says, in one of the documents in our possession, speaking of the lake, that, in the year 1813, he was appointed commandant of Fuerte, surveyed the map of said lake according to the scale of its extension and prolongation, and found it to be an oblong square, in length from north to south 60 leagues, its extreme head widening where the city of Grenada is situated on the lake; here ships' registers are entered, and these vessels trade, by the way of the Atlantic, with the port of San Juan, (the communication being through the river of the same name,) and its breadth, extending on the west side where *Nicaragua* or Villa de Rivas is situated, in the narrowest part between the Pacific and this great lake; which mid narrow portion of land is so celebrated for its rich and abundant harvest of cocoa, and containing from thirteen to fourteen thousand souls, the entire population being, if we include the suburbs, twenty-two thousand.

From the coast of Lake Nicaragua, directing the compass to the east, you discover the Pacific ocean, and an intermediate space of level (but for the most part winding) land. This strait, or narrow passage, is from ten to twelve leagues in length, until it reaches the mountain of the same name; it is watered by several rivers, some of which flow to the eastward and fall into the great lake, while others direct their course to the west, and empty themselves into the Pacific; their sources being so near one another that they almost cross, thereby presenting the means of forming a canal which may unite both seas.

On the borders of this lake the quantity of timber is inexhaustible, and is composed of the qualities hereafter mentioned. You also find various kinds of provision, the finest oxen, abundance of game, the most delicious vegetables, and in the lake the most exquisite fish and shell fish. In a word, the many and flourishing rivers which, by a thousand different streams, discharge their waters into this lake, will make the provinces of Nicaragua and Costa Rica the grand depots of commerce at a very trivial expense.

Secondly. The distance which there may be from the shore of the lake to the south sea, (that is from east to west,) in the province of Nicaragua, which is the narrowest part of all the province, is seven leagues by elevation, and in a direct line, and its least breadth from five to six leagues. The best place where a canal can be opened from the lake to the Pacific, is in the vicinity of the mountain called Nicaragua, and from thence to the port of San Juan de Brito; for the reason that the lake contains more water in this part, or on this side, than in any other place; and, moreover, because this is an open and good anchorage port, being distant from the town of Nicaragua only five leagues. The intermediate land lying between the south sea and the lake is low and sandy, having intervals of hills, the greater portion of which decline towards the ocean, and the streams which issue from their summits discharge

themselves eastwardly into the lake, and we[illegible]ly throw themselves into the sea.

Thirdly. The river San Juan has its source at a place called Fuerte de San Carlos, and forms, by means of its channel, the great fresh water lake of Nicaragua. It runs forty leagues, and empties itself into the Atlantic through a narrow *baos*, which contracts itself in several places. This river is capable in itself alone of collecting all these immense tributary streams, without once leaving its own bed. (Account of alcalde Don José Aranda.) The entire length of the river is navigable by making use of oars, and rowing against the upper and lower currents. There are three rapids or falls, (*raudales;*) the first on leaving Fuerte, called Del Ford, the second San Juan, and the third Machuca. Descending them, oars are used; but to ascend them, recourse is had to a *palanca*—that is to say, by portage. The strongest and most violent is that of San Juan; but they might all be levelled at the small cost of $——, such having been the estimate made by the colonel of artillery, Don José Maria Alejandro. Its banks are healthy, and all along covered with timber of every species. (5th and 6th chapters of the account of Captain Gomez de Lara.)

Fourthly. The port of San Juan, on the Atlantic, is very open, its anchoring ground capacious, and its climate so very wholesome that the troops of the garrison stationed at Fuerte de San Carlos, as a corps of observation, have constantly been in the habit of petitioning to be put on that service, in order to recover their health; they are, perhaps, the most healthy in all America. It is distant ninety-five leagues from the city of Grenada, situated on the same shore; that is to say, fifty from the lake, and forty-five from the river. On its right lies the port of Martina, in the province of *Costa Rica*, only separated from it by a level coast of fourteen leagues in length. These are places which might carry on the most advantageous intercourse, either in a military or commercial point of view.

Fifthly. The defence of both the port and river, according to the opinion of intelligent men, is most easily to be effected, as was proved to the English by the considerable losses which they sustained in several of their attempts to make themselves masters of these provinces. The military works of the present day, although upon a small scale, are, nevertheless, both solid and regular. (Plan of defence, &c.)

Sixthly. The abundance of timber in the said port of San Juan, and throughout the whole extent of the coast from the Puerto de la Culebra, and on the northern side from Escalante, is inexhaustible, whether it be in cedars, mahogany trees, laurels, amber, melons, brush wood, ship timber for mast and yards, and all kinds of round lumber, together with the finest Brazil wood for dying. There are all the aforementioned woods (excepting the Brazil wood) to be found in the vicinity of the Pacific, around the lake, and around the borders of the river San Juan. Here we also find the oil of *comibar cativo*, the mangrove tree, and the gum-dragon-blood wood.

Seventhly. The productions of the country are so various, and the articles for exportation so numerous, that it would be presumption to attempt to give an exact enumeration of them; but, as some account of the produce of these provinces and the nature of their *soil* is most essentially necessary in a statement of this kind, we proceed to say, in general terms, that nature has favored this *happy land* with the rarest productions and curiosties which are contained in the best furnished and complete European cabinets, and even with many of which they cannot boast, being articles unknown to them, and peculiar to our *prolific earth.* We possess the richest gold, silver, copper, lead, iron, zinc, and quicksilver mines, and present them to the mineralogist; gums, balsams, woods, and herbs of powerful fragrance, perfumes of every description, and resins, all vying with those of Arabia. The variety of woods is so astonishing that it would require a perfect knowledge of natural history to be enabled to classify them; suffice it to say, that those for building lumber and dying abound to such an extent that it costs nothing more to those who have occasion for them than the mere trouble of felling them. The animal kingdom is so multifarious and diversified in species, and game so very abundant, that, in this latter respect, this country is alone sufficient to supply the markets and wants of the entire universe. The fish, in both river and lake, are delicious; in the former they catch the *manati*, or sea-cow; the turtle is found on both shores; tortoise shell exists in great plenty, and the pearl fishery is particularly productive on the south bank. The snail, or periwinkle, called *murici*, which yields the famous violet dye, equal to the Tyrian, is very common, but the inhabitants, unfortunately, do not know how to derive advantage from this valuable acquisition. The tobacco of this portion of America is said to be superior to that of the Havana.

Eighthly. The fecundity of the soil and the goodness of the climate of these provinces—they being watered by a thousand inexhaustible streams branching off in all directions, and possessing, as they do, the best ports of all North America, and these so well disposed and located for the arrivals of vessels, as well as the prompt, cheap, and easy construction and repairing thereof, together with many other favorable circumstances relating to their produce—all tend and conspire, in a very forcible degree, to promise the most expeditious and happy results. If to this be added the manners and habits of the natives, which are far better than one would be led to imagine from the little instruction they have received—indeed, so very honest and peaceable are they, that theft and litigation are entirely unknown to them—in a word, the public may safely rest assured that if one thousand families, of good morals, and partly composed of artisans, were to migrate to this country, and should pay due deference to the articles of their colonization, they would unquestionably make incredible progress in a short space of time.

The principal towns of the province of Nicaragua are—Grenada, on the lake, (of which we have already made mention;) four leagues from thence lies Mazaya, a town containing 26,000 inhabi-

tants, being the same amount of population as its district, bordering along an isolated but deep and navigable lake. To the northeast of Grenada is the pretorian town of Managua, situated on the shore of the Lake Managua; its water fresh; circumference thirty leagues, with good anchorage, and communicating with the great Lake Nicaragua by means of the river Fépitapa; of easy navigation to steamboats, by stemming against a rapid which falls at the place where it forms a junction with the lake. In the same direction, and six leagues to the northeast, on level land winding along the lake of Managua, is seated the city of Leon, capital of the province and seat of government, with metropolitan church, being four leagues distant from the sea, and ten from the celebrated port of Realejo, containing a population of 30,000 souls. A thousand line-of-battle ships can conveniently and safely ride at anchor in the said port of Realejo.

Returning to the south, you behold Nicoya, distant twenty-five leagues from Grenada; here the inhabitants carry on the pearl fishery, and also that of the famous snail, or periwinkle, called *murici*, which produces a dye of the most beautiful violet color. At —— leagues from Nicoya lies the town of Culebra, of great extent and consequence, abounding in ship timber of every kind.

Directing your course northeast from the coast of the south sea, you arrive at Pueblo Viejo, a place of great trade, only twelve leagues from Leon, the capital; from whence it is separated by a level and fertile country which trades with Honduras and San Salvador, by the Gulf of Conchagua, and other places.

Returning back into the interior, you meet the townships of Nueva Segovia, Matagalpa, and Chontales, each containing a population of 40,000 souls.

Turning aside, and winding along the right bank of the river San Juan, extends the province of Costa Rica, enjoying a delightful climate and rich soil, producing every species of natural productions, and so prolific in minerals that its inhabitants, all backward as they are in the knowledge of mineralogy, still derive the greatest advantages from this branch of their produce, and, at the smallest calculation, are in possession of twenty five veins of the finest and purest gold. The capital city of this province is called Cartago; it lies between both seas, being thirty leagues equi-distant from each, and sixty from the river San Juan, with which there is an easy navigable communication by means of a river which rises in its vicinity, and which, after running its course for many leagues, falls into the river San Juan thirty leagues from the mouth of the latter, where it discharges itself into the Atlantic.

This province, at a very moderate expense, could render her ports both open and commodious; among others, that called Matina, on the north sea, near the mouth of the river San Juan, and that named Punta de Arenas, on the south sea, lying near Nicoya.

The aforegoing are the principal parts of the information which we have conceived it necessary to make known in relation to the negotiation we are now treating of. Secondary works and statements on this head are omitted, though they cannot fail of proving

very useful and important on after occasions. For the present, what is communicated will suffice for the intelligence and safety of such as may feel disposed to embark in the undertaking.

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NEW YORK, *September* 17, 1824.

I hereby certify, that the foregoing is a true and faithful translation of the original, in Spanish, handed to me for translation by Mr. Cañaz, minister plenipotentiary from Guatemala to the United States of North America.

JOHN WILLIAM FAY,
Translator of languages.

Considerations on the subject of a communication between the Atlantic and Pacific oceans, by means of a ship canal across the isthmus which connects North and South America; and the best means of effecting it, and permanently securing its benefits for the world at large, by means of a co-operation between individuals or companies of different nations, under the patronage of their respective governments: By a citizen of New York, formerly United States consul at Lima and for the ports of Peru.

Among the various improvements which have been made, or which are in progress or contemplation on the face of the earth, there is not one of greater importance to mankind in general, or to the people of America in particular, than that of opening a navigable communication for ships between the Atlantic and Pacific oceans through the isthmus connecting the two Americas; because it would diminish the distance and facilitate the intercourse between greater bodies of the human family, and to a much larger extent than is practicable by human means in any other part of the world.

This grand object has been contemplated ever since the discovery of America, as a necessary result of the form and position of this continent, and the wants of trade and intercourse between its different sides; but during the long continued sway of Spain over the isthmus, and through her contracted policy, it could not be effected, and was necessarily postponed until a more propitious period should arrive.

In consquence of the emancipation of the Spanish colonies on this continent, such a period has at length arrived; and the accomplishment of the grand object has been hailed, by some, as one of the chief advantages of a commercial nature that would flow from that glorious revolution; and has been characterized by others as "probably the mightiest event in favor of the peaceful intercourse of nations which the physical circumstances of the globe present to the enterprise of man."

It has, therefore, occasionally engaged the attention of govern-

ments as well as individuals for some years past, and been the subject of public negotiation, as well as private contract; but remains as yet unattempted, and, for the present, apparently dormant. It is not abandoned, however, but is cherished by many reflecting and enterprising individuals in different parts of the world as a consummation not only devoutly to be wished, but as fast approaching in the general progress of events, towards which they would cheerfully contribute all in their power, whenever ripe for execution and judiciously set on foot.

Under these circumstances it cannot be improper for any individual, however obscure or uninfluential, to endeavor to draw public attention to the subject, by suggesting his own ideas and plans for examination, and inviting others; nor can it be premature to present and discuss the subject at a period like the present, *when the spirit of improvement is abroad on the earth*, and no scheme is left untried that promises utility to man—*a spirit* that animates all enlightened nations, and extends to every method of improving their condition; that produces concert of action for general good between governments as well as individuals, and leads to undertakings and arrangements for the benefit of large portions of the world as well as its minor parts. The consideration of the subject is therefore not only proper and seasonable, but the period seems to have actually arrived when this project, "the mightiest in favor of the peaceful intercourse of nations," has become ripe for execution, and requires only a proper concert of action between those most deeply interested in its results to be carried into effect. If ripe for execution, and depending on concert alone, it follows, no doubt, that, like other grand and important public objects, *the mainspring of its achievement must be the awakening public attention to its merits, and combining public exertions in its favor.*

To excite that attention in some degree, and to induce, if possible, some concert of action towards achieving the end, is the motive and object of the present publication. Its author has been led to direct his attention to the subject at intervals during several years; originally impelled by official duty when employed in a public station abroad, and subsequently by a strong desire to contribute something towards the good of his country and the world; and, consequently, through various inquiries, researches, and personal examinations into it, he has probably acquired as much knowledge of the facts and circumstances bearing on it as is yet possessed by any one; the result of which, in part, he now begs leave respectfully to submit to the public.

Before going into details, however, it is thought proper to premise, as the result of much reflection, strengthened by many able opinions, that, *considering* the object in view to be interesting in a greater or less degree to all parts of the world, and highly important to all America and a great part of Europe in particular; that whatever is to redound to the benefit of so many nations, ought to be effected through common means and united exertions, and not to be left to the efforts of a few individuals, or a private company unassisted or unrestricted; and that the enjoyment of its advan-

tages, when completed, should be secured to the world at large upon equitable terms, free from monopoly, restrictions, or impositions—the work ought to be undertaken and completed on public or national account, or by an association of individuals of different countries, under the patronage of their respective governments, and their united guaranties, and not by private individuals alone, nor by a single government. *Considering*, also, that the amount of capital required may exceed what would comport with the convenience of the inhabitants of a single country to advance, especially those of the United States or any other part of America, and that Europeans are possessed of vast surplus funds, seeking investment everywhere, and of course ready for this purpose, if desired, and rendered inviting; that while the latter can so easily furnish capital, the former can more easily, from proximity of situation and other circumstances, supply labor, skill, and materials, and attend to the execution of the work; that all the efforts hitherto made by individuals of our own country and others, in forming associations, and obtaining privileges for executing such a work, have proved abortive, and caused an abandonment of the object on their part; and especially that the distinguished head of one European nation, the king of the Netherlands, together with an association of his wealthy and enterprising subjects, have already, some time since, turned their particular attention to the subject, and taken some preliminary steps in relation to it, and invited foreigners generally to unite with them in prosecuting the work for common benefit, (although extraordinary events have occurred in the Netherlands, causing a suspension of their proceedings,)—it results clearly and forcibly, without any weighty considerations to the contrary, that a *full concert of action* between all those in Europe and America, *governments as well as individuals*, who may be disposed to promote the great end in view, should be brought about, if in any way possible, and one general association formed out of the whole, for executing the work on joint or common account, and securing its benefits permanently for themselves and the world at large. But if, unfortunately, such an association should be found impracticable, after a full trial, (which can hardly be anticipated,) that then a combination should be formed between the citizens of the United States and those of the Netherlands, at least, (who are believed to be in favor of such a plan,) open to any other persons who should choose to co-operate for the purpose executing the work on joint account with each other, under the patronage of their two respective governments.

Without further preliminary remarks, the subject in hand will be explained and illustrated within a short compass, as well as the writer may be able with the information possessed, under the following heads, into which it may most aptly be divided, namely: *the nature and extent of the work* in contemplation; its *practicability*, either with ease or difficulty; its *probable cost*; its *public utility*; its *private revenue*, and the *best mode of execution*, or the most judicious arragement for its accomplishment, and the perma-

nent enjoyment of its benefits, together with some *general remarks, or reflections.*

I. The nature and extent of the work in contemplation.

It ought certainly to be a *ship canal*, with locks to ascend and descend the dividing ridge between the two oceans, of such large dimensions as to admit the passage of loaded ships, or vessels of almost any burden, with facility and despatch, from one ocean to the other, so as to supersede entirely the necessity of voyaging round Cape Horn. Nothing less than a canal of that description can possibly satisfy the wants and desires of the world in this respect at the present day; nothing inferior to that ought now to be attempted or aimed at, if, by any means that can be brought to bear on it, such a work can possibly be accomplished. A boat canal or railroad might answer a good purpose, and would certainly be better than no improvement at all of the passage across the isthmus; but not to be compared with a ship-canal, nor even capable of turning the current of trade and intercourse from the long route by way of Cape Horn. Such a road or canal would leave indispensable the transhipment of cargoes from vessels in one ocean to those in the other, in boats or carriages, over the intermediate space, at much expense, risk, and loss of time, and also the employment of two sets of vessels—one in each ocean—for carrying the same cargoes to market; which would overbalance the advantages of using it, and the difference of cost between it and a ship canal, and, of course, continue the preference, in a great measure, if not entirely, of going round Cape Horn. It would justly be considered a half-way measure only, unsuited to the wants and capacities of the world at the present advanced and enlightened period, and far beneath the proper aim and scope of national efforts or endeavors, while the difference of cost between it and a ship canal would not be worth regarding, in comparison with so great a difference of utility to the world at large. Consequently, if any communication be made between the two oceans, through the united means and exertions of different nations, or associations of individuals under the patronage of different governments, it ought certainly to be by means of a grand spacious canal from one ocean to the other, with locks to ascend and descend the intervening ridge of land at its lowest elevation, navigable for loaded ships, or vessels of the largest size, usually employed on the Atlantic and Pacific, and kept in such order, and under such control as always to be passed through by vessels of all nations, except *vessels of war*, with speed and safety, at a moderate expense, or toll.

II. Its practicability, either with ease or difficulty.

This may be inferred with certainty, from the construction of similar works in different parts of the world, and from the surveys and examinations heretofore made along two different routes across the isthmus. Whatever has been done in one place, can of course be done in another similarly situated, by the use of similar means. It is well known that numerous boat canals, and a few ship canals, of great lengths, and over great elevations, have been made in dif-

ferent parts of the world, and also some very deep cuts or excavations through the earth; (as in the valley of Mexico, to prevent the overflow of waters;) wherefore the same may be done on the isthmus in both respects. Nothing is wanted for a canal, of any length or dimensions, but sufficient water at an elevation to feed and supply its summit level; and there is no other difference between constructing a large canal and a small one than the cost or expense. That difference may be very great, but not very material, nor even, in some cases, very objectionable. If the cost of fifty or sixty miles ship canal be equal to that of five or six hundred miles boat canal, and the income or benefits resulting from it be in proportion to the cost, the amount of outlay forms little objection, and to large capitalists may even be some recommendation. Let water be supplied at a proper elevation, and, by means of a sufficient capital, a canal of any length or dimensions can be made anywhere. Upon the simple fact, therefore, of a supply of water at a proper elevation, depends the practicability of a canal across the isthmus, either large or small; but, whether with ease or difficulty, at a very large or moderate expense, depends on various other circumstances.

From surveys and examinations already made upon the isthmus along two different routes, the fact of a supply of water at a sufficient elevation has been fully ascertained. Those surveys and examinations were made formerly under the direction of the Spanish government, and latterly under that of the new governments of Central America and Colombia, while the latter existed under Bolivar; the one by the way of Lake Nicaragua, and the other by the way of Chagres and Panama. According to various authorities, both routes were found adapted to the purpose by the engineers formerly employed under the Spanish government, but, for political considerations, were not permitted by the government to be improved for the purpose. Since the emancipation of the Spanish colonies, both routes have again been explored; the former by engineers employed by citizens of this country, and by engineers employed by the king of the Netherlands; and the latter by engineers employed by Bolivar, while president of Colombia, in 1828 and 1829, and also by private individuals.

The result of these various surveys and examinations has been, in regard to the route by way of lake Nicaragua, to inspire such a confidence in its practicability as to lead to contracts and engagements for the construction of a canal in that way, (in one case at least of a ship canal,) by the Holland Company; and, in regard to the route by way of Chagres and Panama, a similar confidence in the minds of all who have examined the authorities, and especially of those who have also gained some knowledge of the route from their own personal examinations and inquiries, and other sources.

Which of the two routes is preferable need not be ascertained long beforehand; to know that one or the other is barely practicable, is sufficient for preliminary purposes; and that there is more than one practicable, is highly favorable to the enterprise, because it affords a choice between them, depending on their natu-

ral advantages, and on the terms to be obtained from those controlling the territory of each, as to the cost of the work and the enjoyment of its benefits.

As to the degree of ease or difficulty with which a ship canal may be constructed along either of those routes, that may be judged of, in some measure, from the following circumstances:

By the route through lake Nicaragua, a ship canal would require an excavation of proper depth and breadth, (about twenty-two feet deep, forty feet wide at bottom, and one hundred feet wide at top,) for a distance from sixty to seventy miles between the Atlantic and the lake, with locks to ascend about one hundred and forty feet to the level of the lake; and another similar excavation of about twenty or twenty-five miles long between the lake and the Pacific, with locks to descend about the same number of feet; and if a cut or excavation, on a level with the lake, through the dividing ridge or space between it and the Pacific, could not be effected, then, with additional locks, to ascend and descend that ridge, and a feeder of water from a higher level at a considerable distance. Thus a canal of two parts, about eighty-five or ninety miles long together, connecting lake Nicaragua with both oceans, would afford a navigation from one ocean to the other, about one hundred and eighty or ninety miles long, including a portion of the lake to be used as a part of it, and would terminate at each end in a good harbor, or one capable of being made good and sufficient for the purposes wanted.

By the route of Chagres and Panama, a ship canal would require a similar excavation for a distance of between thirty-five and fifty miles; varying in proportion as the bed of the river Chagres and its tributary, the Trinidad, might be used for the purpose, between a port on the Atlantic side called Navy bay, or Port Limon, near the mouth of the river Chagres, and a port on the Pacific side called Chorrera, at the mouth of a river of that name, or the port of Panama, at the city of the same name; with locks sufficient to ascend and descend the dividing ridge between the two oceans, and a cut or excavation through a part of it, where water may be deficient to supply the summit level; the whole elevation of which ridge above either ocean is believed, on good authority, to be less than two hundred feet, and its breadth quite narrow, and easily cut through to a level with streams of water which would answer as feeders a sufficient distance each way. Thus, a canal of two parts—the one only three miles long, to connect Navy bay with the river Chagres; and the other between thirty and forty-five miles long, from the junction of the rivers Chagres and Trinidad, or somewhat higher up the one or the other to the Pacific, at the port of Panama or Chorrera—would afford a navigation, from one ocean to the other, of between fifty and sixty miles long, including a portion of the two rivers to be used as a substitute, and would terminate on the Atlantic side in a very excellent harbor, and on the Pacific side in one capable of being made equally good.

Under this head it may be further observed that, besides the two routes described, there are others which have been represented

affording great facilities for a communication between the two oceans, but probably meant for boat canals only, and even for that purpose not preferable to those described. It is, however, possible, and barely so, that, in the event of further explorations of the whole isthmus between North and South America, some other route more eligible for a ship canal than any yet known may be discovered; and as such explorations will no doubt be made before the work is undertaken, the very best route discovered will of course be selected.

Upon the whole, therefore, the construction of a ship canal along the one or the other route thus partially described, may be considered as practicable without much difficulty, and that most important point as established.

III. Its probable cost.

This cannot be ascertained or estimated with any degree of accuracy from data at present known; but, from a comparison with other similar works, may be conjectured at not exceeding twenty millions of dollars. The only works of the kind from which to draw any inference applicable to this, are, the Holland canal, from Amsterdam to the ocean at the Helder; and the Caledonian canal, across Scotland, from the East or German sea to the West sea or Irish channel. The Holland canal is fifty miles and a half long, twenty feet nine inches deep, thirty six feet wide at bottom, and one hundred and twenty-four feet wide at top, with two tide-locks at the extremities, and two sluices with flood-gates in the intermediate space; being on a level with the sea, and supplied with water from thence at high tides, and occasionally by the aid of a powerful steam engine. It was completed in the year 1825, and cost about five millions of dollars. The Caledonian canal is sixty nine miles and a quarter long, from sea to sea, including the intermediate lakes forming a part of the line; but it has only twenty-three miles of excavation, with an expensive deepening of those lakes. It is twenty feet deep, forty feet wide at bottom, and eighty or ninety feet wide at top; having twenty-three locks to overcome an elevation of ninety-four feet. It was completed in the year 1822, and cost about four and a half millions of dollars.

From these two works, some inferences may be drawn in relation to the cost of that in contemplation. Its length and dimensions, by the route of the Chagres, would be similar to that of the Holland canal, and its lockage probably to that of the Caledonian. As the former cost about five millions, and the latter about four and a half millions of dollars, it would, probably, be quite safe to estimate the cost of this as not exceeding twenty millions of dollars: making allowances, one way, for the much higher price, on the isthmus, of scientific aid, and labor requiring skill, and of some of the materials, with disadvantages of climate, and perhaps some unknown physical obstacles; and allowances, the other way, for the low price of common labor and provisions there; the abundance of timber and stone of all sorts; the almost entire use of land for nothing, and the easy acquisition of extensive territory for a trifle, along the canal, and at each end, which would grow into value by

means of the canal, and might possibly, in time, reimburse a considerable proportion of its cost.

There is another great public work recently completed in Sweden, called the "Gotha canal," which may afford inferences favorable to the one in contemplation, but no particular account of it has yet been published. It is stated in the public prints to be one of the greatest works of Europe, and to have cost ten millions of rix dollars. Its length and dimensions are not mentioned; but the elevation overcome in its whole course is known to be above three hundred feet by lockage—more than three times that of the Caledonian canal.

Although estimates of the cost, without better information than has yet been obtained, must necessarily be very uncertain, yet it seems quite probable that it would not exceed twenty millions; and it is beyond all doubt (which is enough to be known beforehand) that the cost of the work will be trifling indeed, in comparison with its immense value when completed; that the capital invested in it may be made, at all events, to bring a fair interest, or, if not restricted, an extravagant interest, (which ought, however, to be guarded against,) and that the world would be immeasurably benefitted besides; wherefore, a few millions, more or less, in the cost of the work, deserves but little weight in forming conclusions about undertaking it.

IV. Its public utility.

The public or general advantages that would result from the execution of this project are too immense either to be foreseen to their full extent, or to be described in detail, so far as they are apparent; but a few of its most important and immediate effects may be thus specified.

The saving of above *twelve thousand miles* in the circumnavigation of South America by Cape Horn, and avoiding the delays and dangers of doubling that cape, at all seasons of the year, would be its first general effect; which would be a reduction of *distance, time, expense, and risk, far exceeding what the globe admits of being effected anywhere else.* By means of a ship canal across the isthmus, through either of the routes mentioned, (which are both within the tropics, where no changes of weather interrupt navigation, as well as nearly central between the most populous and wealthy regions of America, and also in the most direct line from Europe and the United States to the eastern countries of Asia and the islands of the Pacific,) the trade and intercourse between all of them, in every direction, would become comparatively *easy, safe, cheap, and rapid;* and millions of the human race be thus brought into communion with one another, who are now widely separated by nature's barriers, and scarcely known to each other.

But, to specify its effects more particularly, (as they well deserve to be,) it is apparent, from a mere inspection of the map of the world, and a slight calculation of the wants and interests and desires of a large portion of its inhabitants, especially on this continent—

1. That the inhabitants of the western side of America, from

Mill inclusive on the south, to the Russian possessions on the north, a distance of about 8,000 miles, together with those of the numerous islands of the Pacific, would be peculiarly and most extensively benefitted, by reason of its opening to them all an easy and intimate intercourse with the inhabitants of the eastern side of America and those of Europe, and the best means of effecting their exchanges with the world in general; and also facilitating the introduction among them of those improvements in agriculture, arts, and sciences, and especially in self-government, wherein they are yet so wofully deficient.

2. That the inhabitants of the United States would be next highly benefitted, by reason of the immense increase of commerce in general; which would result from the facility of intercourse with the western side of America, and the islands of the Pacific, wherein they would participate more largely, and from which they would reap greater advantages than Europeans or others, in consequence of their proximity and superiority in navigation.

3 That the very rich, extensive, and highly important trade of the United States, and of Europe, with China, Japan, and the Indian archipelago, would be much facilitated and increased by reason of shortening the distance above four thousand miles, and saving time in the voyages still more in proportion, from the whole route passing through the most favorable latitudes for winds and currents each way.

4. That the immense and still growing whale fishery, and skin and fur fishery of the United States, and other nations in the Pacific ocean, would be exceedingly accommodated, extended, and made more lucrative, by shortening the voyages of those engaged therein above one-half, and enabling them to realize the fruits of their enterprise, skill, and capital, at much less risk, expense, and loss of time.

5. That the settlement and improvement of the extensive and important territory of the United States bounding on the Pacific ocean, and its general advantage to the Union, would be greatly facilitated and augmented, by bringing it, on an average, about twelve thousand miles nearer to the seat of government and the States on the Atlantic, by way of the isthmus, than it is by way of Cape Horn, and admitting of a rapid and regular intercourse with it, by means of a steam navigation and otherwise.

6. That the commerce in general of the United States, and of the world at large, would become more extended, and the products of agriculture and manufactures of the various portions more demanded, by reason of its opening new markets to each, through the increased facility of exchanges.

7th, and Finally: That, in consequence of the more intimate intercourse and communion of such numerous and immense bodies of the human race, the characters of nations would gradually become more improved and assimilated; a pacific and harmonious disposition more generally cultivated; forms and the administration of governments amended; liberty, knowledge and virtue more widely diffused; and prosperity and happiness more generally enjoyed.

From this imperfect sketch of the tendency and effects of the execution of this project, it is manifest that there is not an improvement to be made on the whole globe so highly beneficial to mankind in general as the one in contemplation; nor, from what has been shown before, is there any one so easy of execution, in proportion to its benefits.

V. Its private revenue, or profit on capital invested.

Suppose the work to cost twenty millions of dollars, (as has been estimated,) the interest thereon, at four per cent. per annum, (the full value of money in Europe,) would be eight hundred thousand dollars annually. But, in order to present sufficient inducement to advance the capital required, and suitably to reward contributors to an object so beneficial to the world, a higher compensation ought to be allowed, and, as far as possible, to be guarantied; limited, however, from considerations of general equity and policy, to a rate that would not be extravagant. Without assigning, at present, more particular reasons, it will be assumed that the rate of interest should be about double the usual value of money; that is, about eight per cent. per annum on the capital invested, and never allowed to exceed that rate; payable biennially from the period when the income of the canal shall be sufficient to meet it, with an accumulation on the advances of four per cent. per annum until that period arrives. This would require a revenue from the canal of one million six hundred thousand dollars annually.

It is easy to show how that amount, and a great deal more, would be produced, or rather would be saved, by means of the canal, upon the present commerce of the world that would flow through it, whenever opened, without calculating its certain and almost unlimited increase, and consequent larger savings in time.

The mere difference in the amount of insurance paid, the interest of money invested, and the expenses of navigating vessels employed, between voyages from the United States and Europe to the Pacific ocean, and all the countries bordering on it, by way of the canal, or by Cape Horn and the Cape of Good Hope, would far exceed annually the one million six hundred thousand dollars required for interest on the cost of the canal. But it is impossible to make estimates from present information more precise or accurate than as approximations towards correctness; of which the following is a specimen, viz:

The average length of voyages from the United States, round Cape Horn, to the principal ports on the west side of America and to the whaling districts of the Pacific, is above four months; while, by way of the canal, it would not exceed one month; making a difference of three months each way, and six months on a voyage out and home, usually performed in about a year, except by whaling vessels; consequently, there would be a saving effected, of *insurance* on vessels and cargoes, and of *interest* on the amount of their cost, and of *expense* of navigating those vessels, just in proportion to the saving of time on the voyages. This saving would be about one-half of one per cent., both on the insurance and on the interest, as is usually paid, and considerably more on the expenses

of navigation; making not less than ten per cent. per annum. It is estimated there are at least one hundred ships or vessels of the United States sailing annually from home ports for the Pacific, and as many returning thence, including those employed in whaling; the aggregate value of all which, with their cargoes, may be estimated as high as five or six millions of dollars; and ten per cent. saved thereon would be at least half a million of dollars.

The British and Europeans exchange annually with the western side of America to a much larger amount, and carry on also a considerable whaling business in the Pacific. As, from the relative distances, the time to be saved in their voyages would be rather less than those from the United States, and the saving of insurance, interest, and navigating expenses, of course, proportionally less; yet, as the amount of their exchanges is so much larger than ours, it may be about correct to estimate the whole saving on the trade of Europe with the Pacific through the canal as at least equal to that on the trade of the United States through it, namely, half a million of dollars; making together, thus far, at least one million annually. In addition to this, must be estimated the saving on the whole trade of the United States and of Europe with China, and the neighboring countries and islands of the Pacific, which would be carried on by way of the canal, because that route would be above four thousand miles shorter than by the Cape of Good Hope, without crossing the equator, or reaching high latitudes, and would reduce the length of voyages out and home at least two months on an average; consequently, as much as three per cent., if not more, on the aggregate amount of that trade must also be estimated as to be saved by the canal; but the amount of that trade is almost incalculable.

From official reports to Congress, it appears that the exchanges between the United States and Canton alone amount to above ten millions of dollars annually. Those between Europe and China and neighboring countries must be a vast deal more—perhaps four or five times as much; but suppose only a little above twice as much, and that the whole amount of exchanges of both Europe and the United States with China and the neighboring countries were only thirty-three millions and a third of dollars; then the saving thereon by means of the canal would be as much as one million of dollars annually, thus making altogether two millions.

Thus it appears that, if the present commerce of the United States and of Europe with the western side of America, the islands of the Pacific, and China, and neighboring countries, should be carried on through the canal, the immediate annual saving thereon, upon the ground stated, without reference to other great benefits, would be not less than two millions of dollars, (and it might be a great deal more;) while the whole revenue required to pay the interest on the cost of the canal, at the high rate of eight per cent., would be only one million six hundred thousand dollars; consequently, there can be no doubt of sufficient remuneration for the capital to be employed. But this calculation does not comprehend all the sources of revenue to be derived from the canal. It merely

shows the saving to be made in effecting the present exchanges between certain parts of the world by means of the canal, and the amount which might of course be levied for the use of the canal, without adding at all to the present charges on the same commerce. Other advantages would justify additional charges if more income were required; but the natural growth of commerce, together with that resulting from the increase of facilities, would soon produce an immense addition, and a vast surplus of income from the canal, unless limited by previous restrictions, as proposed, and as it ought certainly to be.

VI. Its mode of execution, or the arrangements most necessary or expedient to effectuate the design, and permanently to secure its benefits.

This involves what is highly important and extremely difficult, and requires the greatest foresight and judgment. It is, indeed, the main point, on the judicious settlement of which beforehand, the execution of the project and its permanent utility chiefly depend.

Considering, then, that as the work in contemplation ought, for the reasons already given, to be constructed and preserved for the benefit of the world, through the united means and exertions of individuals or companies of different nations, under the patronage of their respective governments, it will be requisite in the first place to devise and adopt the most suitable measures for bringing about such a cordial co operation of individuals or companies, and securing such a powerful patronage of governments, as may be adequate to the end: that, as the right or privilege to execute the work must depend on the will or consent of the government of the country through which the canal is to pass, it will be requisite in the next place to negotiate with the governments of both countries through which a canal is practicable, in relation to the terms and privileges which would be granted by them if undertaken through either: that, as the selection of the best route must depend on previous explorations and surveys of the isthmus, it will be requisite also to employ competent engineers to perform the same, especially in regard to the two routes by way of Lake Nicaragua, and by way of the river Chagres; and upon their report of the characters of both, together with the result of the negotiation with each government for terms and privileges, to determine which of them is entitled to the preference: that, as it will be of the utmost importance to be well secured in the enjoyment of the rights and privileges acquired from the government of the country through which the canal is to be made, it will be further requisite to obtain a guaranty of the same from each of those governments whose citizens or subjects combine to execute the work, by means of treaty stipulations between them and the former for that express purpose; so that these rights and privileges should never be violated with impunity, and that the full benefits of this intended highway of nations should forever be secured to the world at large on equitable terms: and that, as the proper execution of the work, after all the preliminary arrangements shall have been completed, will depend on a suitable organization of the general body of contributors or stockholders, it

will be requisite finally for them to adopt a proper government or system of regulations for themselves and their successors, in relation to this object, under the sanction of legislative charters in each country, and to constitute a superintending board of directors out of the whole body, for the purpose of conducting the operations of the general association, and employing the agents necessary to carry their views into effect.

These considerations indicate the general course or scheme of action to be pursued, in reference to the mode of undertaking and accomplishing the work and securing its benefits. They plainly show, in the first place, the necessity of governmental interference. It is manifest that, from the very incipient steps to be taken in relation to the canal until its completion, and subsequently for its preservation and use, the co-operation of one or more powerful governments, with individuals and companies, is indispensable. This results from various causes, especially the following: From the difficulty of negotiating for the necessary privileges between private individuals on one side and a foreign government on the other, and of obtaining the necessary security; from the inequality of physical strength between the parties negotiating and the want of confidence thence resulting, if no guaranties be obtained; from the danger of revolutions or convulsions in new governments, like those referred to, and their incompetence to enforce their own decrees at all times, if ever so well disposed; from the temptation always existing on the side of a strong party to violate its engagements with a weaker party; and, more especially, from the object in view being one of such great and universal concern as to deserve and to demand the attention and co-operation of governments and individuals in different parts of the world.

It is, therefore, respectfully suggested, and with deference recommended, that negotiations be opened without delay by the government of the United States with those of New Grenada and Central America, for the purpose of obtaining permission to explore and survey the different routes through the territories of each most eligible for a ship canal, from one ocean to the other, and of ascertaining the terms and conditions upon which they would respectively allow such a canal to be constructed; and, also, that competent engineers be employed by our government, as soon as permission be obtained, to explore and survey the isthmus, or at least the two routes pointed out as most feasible, in order to ascertain which of them, from physical circumstances, is entitled to the preference, and what would be the probable cost of a ship canal through either; and, at the same time, or as soon as circumstances render it advisable, that negotiations be opened by our government with such other governments as would probably be disposed to co-operate in promoting the object, especially those of Great Britain, France, and the Netherlands, for the purpose of entering into arrangements to accomplish the great end in view through common means and united exertions.

Such negotiations with the former would probably lead to stipulations or offers, on the part of some or all of them, for contributing

pecuniary aid, if necessary, towards the first cost of the work—at least whenever competent individuals or companies should undertake its construction, and provide for raising the residue of the amount required; but the negotiations should be directed principally to, and would probably eventuate in, the formation of a treaty between the governments referred to on one side, and the government of the country through which the canal is to pass on the other, stipulating all the terms and conditions on which the work is to be constructed and its benefits enjoyed, and guarantying to each other, and to the individuals and companies concerned in it, all the rights and privileges acquired by each in consequence of such treaty stipulations.

The considertions stated indicate, in the next place, the course of proceeding for individuals to pursue in relation to the object in view. If our government should adopt the preliminary steps suggested, they should commence acting in accordance therewith, by endeavoring to form, in the first place, a partial association in this country of such persons as are most disposed and most competent to promote the object, for the purpose of combining their efforts in its favor, and recommending it to the public by their united voice and influence; thus trying to make proselytes and gain strength by degrees, and to bring about in time such an association out of this and other countries as should be adequate to the end.

This first association need not incur expense, nor engage in hazardous measures, but should chiefly advise and consult with each other in regard to the course to be adopted, in concurrence with the steps which may be taken in the matter by our government and others, and recommend that course to the public; and thus ascertain how far public opinion in our own country would warrant the undertaking under proper auspices, and what degree of co-operation could be obtained from abroad. If the result of these measures should prove favorable thus far, (as there are certainly good grounds to expect,) then ulterior measures might easily be devised and adopted, and would readily be seconded by the public in general, for extending the association, and forming a great company out of this and other countries, more or less numerous or dispersed, according to circumstances, but under one superintending board of directors, which should be fully competent, with the aid and patronage of their governments, to effectuate the great design.

The plan or scheme of action thus suggested and explained, for executing the work, and securing its benefits, although the result of much reflection, is recommended with diffidence, because there is room for wide difference of opinion respecting it, especially as regards the very extensive co-operation contemplated. The idea of several governments acting in concert with each other, and with individuals, and a company being formed out of different nations for the attainment of a common end, is, perhaps, novel and unprecedented, and may be deemed by some visionary and impracticable. But it must be considered that the world has recently become more enlightened; that the present is an age of improvement, of enterprise, of vast expansion of mind and physical means; that

mankind have grown more pacific, and philanthropic also, and are generally cultivating peace and friendship with each other; and, consequently, that impediments to united action for common good among nations, as well as individuals, are much diminished, and the inducements and facilities in its favor much increased. The scheme of united action for attaining the great end in view is, therefore, much more likely to meet with favor now than formerly. It would probably strike the minds of the intelligent and patriotic in all parts of the world as worthy of encouragement and adoption; and their sentiments would give an impulse to public opinion, and, finally, to corresponding action. The plan is worth trying, at least, if no better be devised; a failure would involve no disgrace or injury; and success would operate like a victory over human weakness as well as over physical nature, extending benefits to, and improving the condition of, an immense number of the human race.

Having thus, as briefly as the copiousness of the subject permitted, but very imperfectly explained and illustrated, under the heads proposed, the nature and extent of the work in contemplation; its practicability; probable cost; public utility; private revenue, and mode of execution; it remains only, as observed in the introduction, to add a few general remarks.

It may be emphatically repeated, and will no doubt be admitted by every one reflecting on the subject, that this is really and truly the most useful, important, and magnificent improvement which "the physical circumstances of the globe present to the enterprise of man. It has no equal on earth; nor can it possibly have any, by reason of the form and position of the two great continents into which the land is divided by nature, and their surrounding waters. Where else, upon the face of the earth, can a distance of fourteen thousand miles be reduced to two thousand, by means of an artificial passage of fifty or sixty miles? or even sixteen thousand miles be reduced to twelve thousand? avoiding in each case both the equator and high latitudes. Where else, or by what other means within the power of man, can such immense bodies of the human race, now widely separated by natural barriers, be brought into communion with each other, and reap such immense benefits as would flow from this single improvement?

Why, then, shall the world, enlightened as it is, eager for improvements, surcharged with capital rapidly accumulating and seeking investment, any longer forego this great desideratum? Why not improve the present favorable season—so propitious to great achievements, from the prevalence of peace, the march of intellect, and the accumulation of means—to commence this important work, and secure its completion, before a storm arises or cloud appears, or some interruption in the present happy progress of the world's affairs takes place, which is possible, however unforeseen? There is, perhaps, a tide in the affairs of nations, as well as individuals, which, taken at the flood, leads on to immense acquisitions or great achievements; omitted, and all their efforts for years and ages may be baffled by adversities. Now, therefore, is the time for under-

taking this grand enterprise, so long contemplated by the world at large; so much called for and demanded by the wants, desires, and best interests of mankind; so worthy of all possible endeavors to execute it; so ripe for execution.

Besides the fitness of the period for undertaking the work, on whom devolves the duty most imperatively of taking the first steps in relation to it? Is it not incumbent on the government or citizens of the United States to originate the necessary measures, and set the wheels in motion, at least? Are they not, from proximity of situation and other circumstances, best enabled to take the lead and attend to the execution of the work? And are they not more deeply interested in its results than those of any other country—except, perhaps, of the country through which the work is to be made, who are known to be incompetent to take much agency in it? If the affirmatives be true, then there is an obligation or duty imposed or existing, which ought to be discharged; and which, it is believed, requires only to be understood, to induce proper exertion for its discharge.

In regard to the interposition of our government in favor of the undertaking, that will result, as is conceived, from its general duty and obligation to foster and protect commerce, and its particular interest or policy as affected by the measure itself. It is well known to have been the constant aim and practice of our government to enter into commercial treaties with all nations whose trade was worth cultivating; and there is scarcely one maritime country of Europe or America with which there is not such a treaty subsisting. Our government has even long sought, and at considerable expense obtained by treaty with the Porte, a few years ago, the privilege of a passage through the straits of the Bosphorus, for the sake of a trifling addition to our commerce, by access to the ports of the Black sea; and has recently negotiated for commercial advantages with some of the minor powers of remotest Asia. With how much stronger reasons is it called on to endeavor to obtain the privilege and advantage of access to the ports of the Pacific, through a strait or passage that may be opened through the isthmus; and even to aid in the opening thereof—a privilege which, whenever the passage shall be opened, will add to our commerce infinitely more than is gained by our treaty with the Porte and many other treaties together, and would add much also to the general advantage of the world; and how just and expedient would it consequently be for our government to contribute largely towards the expense of opening such a passage, if it can do so constitutionally?

But our government has already given proof of its views in reference to this object by its instructions to our ministers to the Panama convention, some years ago; in which instructions it was expressly recognized as a duty or policy incumbent on the United States to enter into arrangements with other governments, represented in that convention, for opening a navigable communication between the Atlantic and Pacific oceans, through the isthmus, by common means and united exertions. It may be similarly actuated

from duty and policy in regard to the large and important territory of the United States belonging to the Pacific ocean, which would be highly benefitted, and rendered far more useful to the Union at large, by such a communication being opened, than it ever can possibly be otherwise; and it may be furthermore influenced by considerations of convenience and economy in regard to its naval force usually stationed or employed in the Pacific, which could be maintained there, if such a communication were opened, at an expense so much less than it has been heretofore, as to cause a very considerable annual saving—perhaps equal to the interest of a million of dollars. For these various reasons, and others which might be specified if necessary, there can be no doubt whatever of all proper aid and countenance being afforded by our government whenever the occasion arises.

In regard to a co-operation from abroad, it must be taken into consideration, along with other circumstances, as before observed, that some years ago the king of the Netherlands, or a company of his subjects under his special patronage, contemplated the construction on their own account of a ship canal to connect the two oceans by way of Lake Nicaragua, and actually obtained from the government of Central America the requisite privileges for executing the same; but, in consequence of the Belgian revolution, the project became suspended, and remains so yet. It is not, however, abandoned, but will probably be resumed by the association under the same patronage, as soon as circumstances permit, governed by later and more correct information as to the most eligible route. From this may well be inferred the probability of a co-operation between them and an association in the United States, if desired by the latter; especially as it is also known from good authority that the king of the Netherlands and his associates had intended to offer to all foreigners, particularly Americans, the privilege of joining their association on equal terms in the prosecution of the work. No doubt, therefore, exists of a co-operation between an association in this country and one in the Netherlands being easily brought about, if desired; but it would be far preferable to have the same extended to Great Britain and France also; and to have one general association or company formed out of the four countries together, in order to execute the work jointly in the most perfect manner, for the benefit of themselves and of the world at large, subject only to a reasonable toll. A combination so extensive and powerful as that of a body of leading and wealthy individuals of Great Britain, France, the Netherlands, and the United States, aided and patronised by their respective governments, would be able to accomplish the object with great facility and despatch, and render its enjoyment secure and permanent. Those governments need only treat with the governments of Central America and New Grenada for the privilege of constructing a ship canal through the territory of either, according as the one or the other route should be found best, and of using that canal freely and permanently without interference by the local authorities of either, but under the protection and guaranty of the high contract-

ing parties; and then submit to their respective subjects and citizens the selection of the route and the execution of the work, with the control thereof, under reasonable restrictions; but aiding their operations with such legislative favors and such contributions or loans of money as circumstances render necessary or useful and advisable. Thus encouraged, private individuals, or companies of the countries mentioned, would, in all probability, cheerfully advance the necessary funds, and proceed with alacrity to the execution of the work, which would no doubt be completed in a few years.

Whenever that work shall be accomplished, it will indeed be no ordinary task performed, nor common object attained; but the most important improvement effected for the benefit of the world which is within the scope of human exertions, and a monument of glory erected to the governments and nations who shall have patronised and accomplished it.

It may well be asked, finally, why shall not the great end in view be thus attained through concert of action between different nations? Why shall not one monument, at least, of combined exertion to overcome physical obstacles for general good, be raised and transmitted to posterity through the intelligence and philanthropy of the present age? Why shall not the present moment be seized on to commence operations for erecting such a monument?

Not even a plausible objection can be urged against it; while, in addition to the considerations imperfectly sketched above, there are many and irresistible arguments in its favor.

The spirit of improvement, which is abroad upon the earth, seems to authorize and dictate this grand enterprise. The general expansion of mind and increase of physical power, which have taken place in the world, seem to grasp at and demand it. The consummation is not only devoutly to be wished, but may easily be realized and enjoyed, if every intelligent man, possessing power or influence, will perform but a portion of his duty in relation to it.

Documents relating to ship canal by way of Lake Nicaragua, &c.

OFFICE OF AMERICAN AND FOREIGN AGENCY,
New York, March 8, 1838.

DEAR SIR: Your esteemed favor of the 17th ultimo came duly to hand, and has had my immediate attention; but a pressure of business has prevented an earlier answer.

In reply to your inquiries for any information I may possess in reference to the facilities for a ship canal to unite the Atlantic and Pacific oceans, by the way of Lake Nicaragua, &c., I beg leave to state that I effected a contract with the government of Central America in June, 1826, through a confidential agent whom I had sent to Guatemala for that purpose, for the construction of a ship canal by the contemplated route. In the month of October fol-

lowing I executed a deed of trust to my late lamented friend De Witt Clinton and associates, for the formation of a company, with a capital of $5,000,000, the estimated cost of the proposed canal, to carry the enterprise into effect.

Not meeting with the encouragement we anticipated in organizing the proposed company, by the advice of Governor Clinton, and furnished with his letters of introduction to our minister and other influential persons in London, I went over to England, in the fall of that year, in the hope of interesting British capitalists to embark in the undertaking jointly with our American company.

Owing to political disturbances in Guatemala, a general revulsion in trade, and a variety of other untoward events and circumstances occurring at that period, my mission proved abortive.

I remained about ten months in England, and returned home in the fall of 1827, leaving with my agents in London the original contract, together with a number of valuable documents and papers relating thereto, including maps and surveys of the proposed route, executed by order of the Spanish government many years since.

Under these circumstancs, the only information I am at present enabled to afford you on the subject is contained in the papers herewith, as per annexed list marked Nos. 1 to 7 inclusively, which you are at liberty to lay before the committee to whom the subject has been referred, and will please return to me after the adjournment of Congress.

In the hope that your efforts may prove more successful than mine have been in furthering the execution of this magnificent enterprise, I am, with great truth and regard, dear sir, your very obedient servant,

AARON H. PALMER.

WILLIAM RADCLIFF, Esq.,
Washington.

No. 1. Translation of the canal contract with the government of Central America, dated June 14, 1826.

No. 2. Original draught of deed of trust between Aaron H. Palmer and De Witt Clinton and associates, dated October 6, 1826.

No. 3. Letter of De Witt Clinton, same date.

No. 4. Prospectus issued by Aaron H. Palmer in London, soliciting subscriptions to stock of Atlantic and Pacific Canal Company, dated December 12, 1826.

No. 5. National Intelligencer of the 25th September, 1826, containing a brief notice of the contract and the proposed route of the canal.

No. 6. Courrier des Etats Unis of March 26, 1836, containing a notice of the republic of Central America, and the proposed route of oceanic communication by the isthmus of Nicaragua or Panama.

No. 7. National Gazette of March 17, 1836, containing a brief statistical notice of Central America.

No. 1.

Translation of canal contract.

[Stamps of the first class, price $16, for the years 1824 and 1825; ordered to be valid by the State of Guatemala for the years 1826 and 1827.]

We, citizen Francisco Gomez de Arguello, Secretary of State and of the Treasury of the Supreme Government of the Federal Republic of Central America, of the one part, and Charles de Beneski, agent of the New York Company, of the other part, do declare: That a canal being to be opened in the State of Nicaragua for the communication of both oceans, in compliance with the decree of June 16, 1825, several proposals have been presented for that purpose from sundry houses and companies, offering to carry said enterprise into execution; the said proposals having been received and examined by the President of the republic, he thought it fit to submit the same to the federal Congress; this measure appearing to him the most expedient, in order to obtain the desired end, in the acceptance of such as might be more in accordance with the interests of the republic; and the Congress, after having taken the same into consideration, have been pleased to give their assent, by the decretal order of the 20th May last past, to enter into a contract for the opening of the canal with the above mentioned Beneski, in the name of Aaron H. Palmer and associates, conformably with the conditions agreed upon, and annexed to said order. In consequence whereof, I, the Secretary of the Treasury Department, being ordered and commissioned by the President to close and settle with the aforesaid Beneski the contract on the above mentioned conditions, in compliance with said order, and by virtue of the authority with which I am invested by said commission; and I, Charles de Beneski, by virtue of the powers granted to me by said company, and the instructions relating thereto, do covenant the opening of the canal on the terms and upon the conditions set forth in the following articles:

1st. The canal is to be for the navigation of vessels of the largest burden possible.

2d. On this canal there are to be erected the necessary fortifications for its defence.

3d. These works must be built in the most substantial manner; and, on being finished, the government will appoint persons to examine them.

4th. The work of the canal is to be carried on under the direction of engineers and artists appointed and paid by the company, which is bound to defray all the expenses.

5th. The government of the republic will contribute to the most expeditious completion of the enterprise, by permitting the cutting of timber necessary for the works, but no more; by facilitating the surveys and other preliminary operations; and by furnishing the plans, charts, and levellings already made, and procuring workmen, to whom the company is to pay the usual wages.

6th. The government will appoint such engineers as it may deem expedient for the construction of the fortifications on the canal.

7th. They will make out plans, indicate the places which ought to be fortified, and the works will be executed under their exclusive direction; the company having no other interference than in paying the expenses incurred thereby.

8th. Such works shall be considered so urgent as not to be deferred till after the completion of the canal; wherefore, the company, whose interest it is, not less than that of the republic, that the canal should begin to be productive, will be bound punctually to supply the sums of money, the articles, and skilful workmen that may be required to that effect.

9th. The government will appoint, in conformity to law, such commissioners as it may deem proper to superintend the payments of wages of workmen, and also to supervise the settlement of the accounts of expenditures; but without any management of the capital, or interference in the disbursements of the canal.

10th. These accounts shall be transmitted every six months to the Treasury Department, in order that the same may be there audited.

11th. From the date of the receipt thereof, the interest to be paid out of the produce of the canal will begin to be reckoned for such capital till then invested.

12th. The company is to have two-thirds of the net proceeds of the tolls [duties] that the Congress may lay on the vessels, goods, and produce passing through or entering the canal; the republic is to receive the other third part; but she is at liberty, should she deem it expedient, to reimburse the capital, and to pay the interest with other funds. The term of this grant is to be all that may be requisite for the reimbursement of the capital which may be invested in the constructing of the canal and fortifications, together with the interest of the same capital, at the rate of 10 per cent. a year.

13th. Should it happen (which is not expected) that, in any one year, the produce of the canal be not sufficient to pay the interest due in the same year, such interest must not be added to the capital, and, consequently, it will bear no interest whatever.

14th. The debt for the capital invested in the opening of the canal will not be acknowledged nor paid at any time, or by any means whatsoever, but with the tolls or products of the same canal, unless the republic should deem it expedient, at her will and pleasure, to apply other funds to that object.

15th. The company is also to have, during the first seven years following that in which the payment of the capital and interest may be realized, the half of the net proceeds of said canal.

16th. It is likewise granted to the same company, for the term of twenty years, reckoned from the day of the completion of the canal, the exclusive privilege to employ for its navigation steamboats for the transportation of goods and articles, paying only such duties of importation and exportation as may be established.

17th. The company, in consideration of this privilege, and without indemnification for freights, is bound—

1. To carry on board said steamboats the troops, stores, provisions, and ammunition to and from the garrisons and fortifications.

2. To tow the vessels of war of the republic, until out of the canal, in calm weather.

3. In time of war against the nation, to place at the disposal of the republic three-fourths of said boats for her service within the canal.

4. To transport the goods and articles belonging to and owned by the natives of said republic for one-half the price of freight established by the tariff made by said company. For any fraud discovered in this particular, the company shall be indemnified; and it shall, moreover, be considered and punished as other fraud of smuggling.

18th. Whilst the company enjoys the exclusive right of steamboats, they shall be responsible for any omission in regard to smuggling on board said steamboats; in such cases being subject to the penalties already established, or that may hereafter be enacted, by the laws against frauds.

19th. The Congress will regulate and alter the duties to be paid on the canal.

20th. The navigation and passage through the canal will be common to all friendly and neutral nations, without any exclusive privilege.

21st. The government will keep in the lake, and in other points which it may judge proper, the vessels of war necessary for the defence and safety of the canal.

22d. By way, and also as a part of indemnification, the government will prefer, in equality of circumstances, the proposals of the company for the supply of the castles and fortifications of the canal with arms, ammunitions, provisions, and stores; and, also, in the contracts for vessels of war necessary in those points; all this whilst the said company are concerned in the canal.

23d. The company will reserve for the natives of the republic the twentieth part of the shares, which are not to be negotiated but in favor of said natives during one year; which term must be reckoned from the day the company shall open its books.

24th. The canal to be opened shall not be for transhipping vessels (buques de transbordo.)

25th. The importation of all kinds of machinery, tools, and implements useful or necessary for the works of the canal and fortifications, shall be free of every kind of duty; but all of them, together with the buildings erected for the same, shall become the property of the nation after the completion of said works.

26th. The price of the machinery or other implements bought out of the limits of the republic, is to be proved before our minister plenipotentiary or chargé d'affaires resident in the country where such purchases may be made, should any reside there; and in all cases the price is to be proved to the government, with the invoices signed

by the seller, and with other documents, proving that it was the current price at the time of such purchase.

27th. The republic will not receive, after the completion of the works of the canal, such machinery or implements as may have been imported by the company, but which, being deemed useless, were never employed in said works.

28th. If, owing to insurmountable obstacles, the opening of the canal could not be carried into execution, the republic will not be responsible for indemnifications of any kind.

29th. The republic will indemnify the owners of lands, farms, and other property through which the canal may be cut, in conformity to the law.

30th. Only one-third of the workmen employed in the works of the canal are to be foreigners.

31st. This contract is to be signed and closed by the representative of the company residing in this city within three days. The engineers appointed by the same company to make the surveys, are to be in the State of Nicaragua within seven months, at the latest, and they must present to the executive, in detail, the surveys, plans, and levellings. And, the canal being considered practicable, the work is to begin twelve months after the signing of the contract, or sooner, if possible; but if, through some insurmountable difficulty, it cannot be commenced at that time, the company is to give previous notice to the government thereof, and it will allow the necessary time for the same, provided it should not exceed six months.

32d. Should the government deem it expedient, it will appoint engineers to be present in Nicaragua at the time when the surveys are to be made, and the engineers of the company are to agree with the former about the spot where the cutting of the canal must be made.

33d. The engineers who are to draw the plans for the fortifications will be different from those appointed by the company to draught those of the canal.

34th. Mr. Palmer will keep this contract in the company, and cannot sell, make over, or transfer the same to any other company or house, unless under their own responsibility, nor without the knowledge of the government of the republic, which, in such case, will give information thereof to the Congress.

Additional articles.

1st. For the first disbursements which the republic is to make in the surveys, &c., for the temporary fortifications that are forthwith necessary, and also to improve and repair, without loss of time, those that at present exist, the company, on its own account and risk, is to place in the city of Grenada, at the disposal of the supreme government, the sum of two hundred thousand dollars; which sum is to be sent at the same time and within the same term as that allowed to the engineers for arriving in Nicaragua.

2d. On information being given of the arrival of the vessel with

the sum as aforesaid, the government will give the necessary orders for sending a detachment of troops down to the mouth of the river San Juan for the purpose of escorting up the same.

3d. This sum of two hundred thousand dollars, together with the interest thereof from the day of its being received at Grenada, will be paid in the same terms as all other sums spent in the opening of the canal.

4th. Should the opening of the canal not be realized, these two hundred thousand dollars, together with the interest due thereon, at the rate of ten per centum, will be paid in this city within six months after, or in bills on London out of the loan contracted with the company of Barclay.

Explanatory articles.

1st. The one-half of the products of the canal granted to the company is to be understood out of the net proceeds thereof, and after deducting the expenses of collecting the duties on the canal navigation, and such as may be incurred on the repairs of the same and the fortifications thereof.

2d. The privilege granted to navigate the canal with steamboats, is to be understood only to apply to such as are owned by the contractor.

3d. Not only the importation duties will be paid, but also those of transit, whenever goods are received without the duties thereon having been previously secured by the merchants or proprietors of cargoes or ships; and the company, previously to the transhipment or lading of goods, ought to obtain a clearance from the custom-house officers of the republic.

4th. The company is bound to advance the sum of two hundred thousand dollars to the republic. This sum is to be transmitted at the same time that the engineers are to be sent by the company to survey and examine the practicability of the opening of the canal. The interest of this capital is to be computed from the day of its delivery at Grenada, and will be paid to the company after the completion of the work of the canal, and in the same terms with the other sums invested therein.

5th. The reimbursement of the two hundred thousand dollars, and the interest thereon, will be made by the republic six months after the day on which the company may inform the supreme government of said republic that the opening of the canal is not feasible.

I, the secretary of state and of the treasury, by virtue of the authority with which I am vested, do declare, that the supreme government of the nation is by these presents lawfully and solemnly bound to the fulfilment of this contract. In the like manner, I, Charles de Beneski, do also declare, by virtue of the powers to me granted, and of which the requisite evidence remains in the office of the secretary of state and of the treasury, that Aaron H. Palmer and the company are likewise bound, henceforth, to carry into ef-

fect everything covenanted in each of the foregoing articles contained in this present document.

In testimony whereof, we have signed these presents; sealed [L. S.] with the great seal of this republic, at Guatemala, on the fourteenth day of June, 1826.

FRANCISCO GOMEZ DE ARGUELLO,
CHARLES DE BENESKI.

We, the national notaries, certify that the first of the signatures by which this document is authorized is that of the citizen Francisco Gomez de Arguello, secretary of state and of the department of finances in and for the supreme government of this republic, with the other titles that appear at the beginning of this same document, to which full faith and credit is always had and given, as well in judicature as thereout; and the second is that of Mr. Charles de Beneski, agent of the company of New York; and, also, that the seal thereto affixed is that of the supreme government of this republic.

New Guatemala, capital of the republic of Central America, June the sixteenth, of one thousand eight hundred and twenty-six.

FRANCIS. QUIROS.
ANDRES DARDON.
JOSE HERENA.

I hereby certify that Francisco Gomez de Arguello, acting minister of finances in and for the republic of Central America, and Charles de Beneski, agent, &c., this day appeared before me, and severally acknowledged the due execution of the foregoing instrument of writing, for the purposes therein mentioned.

Witness my hand and seal of legation, in Guatemala, this [L. S.] sixteenth day of June, one thousand eight hundred and twenty-six.

JOHN WILLIAMS.

No. 2.

Copy of deed of trust between Aaron H. Palmer and De Witt Clinton.

This indenture, made on the fifth day of October, one thousand eight hundred and twenty-six, between Aaron H. Palmer, of the city of New York, of the first part, and De Witt Clinton, Stephen Van Renssalaer, C. D. Colden, Philip Hone, and Lynde Catlin, of the second part, witnesseth: That, whereas the sovereign Congress of the federal republic of Central America, by their decree of June 16, 1825, determined that a canal should be constructed in the State of Nicaragua, in the said republic, for the purpose of opening a communication between the Atlantic and Pacific oceans:

And whereas proposals were subsequently presented by several

houses and companies, offering to carry the said enterprise into execution, and said proposals having been received and examined by the president of the said republic, he thought fit to submit the same to the federal Congress thereof; and the said Congress, having taken the same into consideration, gave their assent, by an order of the 20th day of May now last past, to the formation of a contract by the supreme government of the said republic, for the opening of the said canal, with Charles de Beneski, agent of the said party of the first part, under the name, firm, and style of Aaron H. Palmer and company, of the city of New York, conformably with the conditions agreed upon and annexed to the said order; in consequence whereof Francisco Gomez de Arguello, secretary of state and of the treasury of the supreme government of the said republic, being ordered and commissioned by the president thereof to close and settle with the said Charles de Beneski, as agent as aforesaid, the said contract on the above mentioned conditions; and the said Charles de Beneski, duly authorized as such agent, did, on the fourteenth day of June, 1826, at the city of New Guatemala, the capital of the said republic, conclude a contract in writing for said purpose, which was signed by the said Francisco Gomez de Arguello as such secretary, and sealed with the great seal of the said republic, and signed by the said Charles de Beneski as such agent as aforesaid, in the presence of the honorable John Williams, chargé d'affaires of the United States of America near the said republic, and attested under his official signature, and the seal of the legation of the United States, upon the terms and conditions mentioned in the said contract or charter written in the Spanish language, a certified translation whereof is hereunto annexed:

And whereas various persons in the United States of America have alreadry associated themselves with the said party of the first part, under the name, style, and designation of "*the Central American and United States Atlantic and Pacific Canal Company*," for the purpose of fulfilling the said contract or charter, and of sharing in the benefits and advantages thereof, and many others are desirous of associating themselves with him for that purpose, the said party of the first part hath assigned, transferred, and conveyed, and doth hereby assign, transfer, and convey to the said parties of the second part, all his right, title, and interest in the said contract or charter, with the reservations, and upon the terms and conditions hereinafter mentioned, *in trust* that the said parties of the second part shall do and execute all such matters and things as shall be necessary and proper to fulfil and carry into complete effect the said contract or charter on the part of the said "*Central American and United States Atlantic and Pacific Canal Company*," and the said parties of the second part are hereby invested with the following powers, and charged with the following duties, as commissioners for that purpose:

1. The capital stock of the said Central American and United States Atlantic and Pacific Canal Company shall be five millions of dollars, and shall be divided into fifty thousand shares, of one hundred dollars each share. Twenty-five hundred shares, amounting to the sum of two hundred and fifty thousand dollars, shall be

subscribed by the citizens of the said republic of Central America, within one year from the time of opening the books of subscription for such stock, and according to the terms of the 23d article of the said contract or charter, and shall be paid for by such citizens; and if the same, or any part thereof, is not subscribed within that period, the said commissioners shall subscribe the same for the benefit of the said company. And the remaining forty-seven thousand five hundred shares, amounting to four million seven hundred and fifty thousand dollars, shall be subscribed and paid for by individuals, companies, or bodies politic and corporate, in the manner hereinafter specified.

2. Subscriptions for the sum of five millions of dollars, to constitute the capital stock of the said company, shall be opened under the direction of the said commissioners, as soon as may be, either at the banking house of the bank of the United States in the city of Philadelphia, and in each of the offices of discount and deposite thereof, or in such other manner as the said commissioners shall designate; of which the said commissioners shall give at least ten days' notice by public advertisement to be inserted in at least two newspapers published in each of the cities of Boston, New York, Philadelphia, Baltimore, and Washington, and at such other places in the United States as they shall direct said subscriptions to be opened; and such subscriptions shall continue open for such length of time as said commissioners may deem necessary.

3. Immediately after such subscriptions are closed, the said commissioners shall meet either in the city of Philadelphia, or such other place as they may designate, and proceed to take an account of such subscriptions; and if more than the whole amount of the said capital stock shall have been subscribed, the said commissioners shall apportion the same in a just and equitable manner, and as they may judge the most promotive of the advancement of this great enterprise; and in case the aggregate amount of the said subscriptions made at all the places aforesaid shall exceed the whole capital stock of the said company, the said commissioners, after having apportioned the same as aforesaid, shall cause lists of the said apportioned subscriptions to be made out, including in each list the apportioned subscription for the place where the original subscriptions were made; one of which lists they shall transmit to each of the presidents and cashiers of the said bank and its branches where such subscriptions may have been received, or to such other agents as the said commissioners may have appointed to receive such subscriptions, that the subscribers may thereby ascertain the number of shares to them respectively apportioned as aforesaid.

4. The sums so subscribed shall be payable and paid in gold or silver coin of the United States of America, or any foreign coin made current in the same by any law of the Congress thereof, or in the notes of the bank of the United States, or the notes of any other bank receivable in deposite by the bank of the United States;

and the funds of the said company in the United States shall always be deposited in the said bank.

5. There shall be paid ten dollars on each share at the time of subscribing, and the payments of the residue of the subscriptions shall be made at such times and places as the said commissioners shall prescribe at the time of opening the subscription; and the stock of such persons as shall neglect to pay for the same according to the terms of subscription, and all previous payments thereon, shall be forfeited; and any excess paid upon subscriptions which shall be reduced as aforesaid, shall be returned to the subscribers by whom the same have been paid.

6. The said commissioners shall have authority to appoint from their own number a president, who shall preside at all meetings of the board, and also a treasurer, and such other officers, agents, engineers, surveyors, artists, clerks, and servants, as they shall deem necessary to execute the business of the said company, who shall receive such salaries and compensation as may be allowed by the said commissioners; and the said commissioners shall, by themselves or agents, make out the contracts which may be necessary for the construction of the said canal and works connected therewith.

7. A majority of the said commissioners or trustees shall be a quorum to transact any business, or to do any act, matter, or thing, necessary to be done for the purpose of carrying into effect the said charter or contract, and to execute the trusts herein mentioned; and any lawful act done by such majority at a regular meeting of the board shall be binding upon the said company in the same manner as if the same were done by the unanimous consent of the said commissioners or trustees; and the said board shall have power to fill up all vacancies in their own number which may occur by death, resignation, or otherwise.

8. The stock of the said company shall be assignable and transferable according to such rules and regulations as shall be made by the said board of commissioners, who shall also have power to make all other rules and regulations necessary and proper to execute the trusts confided to them. They shall from time to time declare, and cause to be paid to the stockholders of the said company, such dividends of the profits of its business as they may think proper, and shall exhibit to a meeting of the stockholders, to be convened for that purpose, annually, a statement of their proceedings and of the affairs of the said company.

9. The said party of the first part shall be the secretary and general agent of the said company, and the said Charles de Beneski shall be their agent at Guatemala, to act under such directions as they may from time to time receive from the said commissioners; and the said commissioners shall have full power and authority to bestow such compensation as they may consider reasonable and just on the said Beneski, for his important services in negotiating the said charter with the federal government of Central America; and also to satisfy all expenses that have been incurred, and all

such reasonable demands as may be made for procuring said charter.

10. And the said party of the first part doth hereby constitute and appoint the said parties of the second part, and their successors, his true and lawful attorneys, for him and in his name, the name of the said firm, or in their own name, to do all lawful acts which may be necessary in the execution of the aforesaid trusts; hereby giving to the said commissioners and trustees and their successors, from time to time full power of substitution and revocation.

11. And it is hereby further covenanted and agreed by and between the said parties, that the aforesaid trusts shall continue to be executed by the said parties of the second part, until an act of incorporation shall be obtained from such competent authority in the United States of America as said commissioners shall see fit to apply to for that purpose. And in case no act of incorporation shall be obtained before the fourth Monday of December, 1827, the stockholders of the said company shall meet on that day, and annually thereafter on the same day in each year, until such act of incorporation shall be obtained, at such place as the said commissioners shall previously designate, for the purpose of electing five commissioners to manage the affairs of the said company, who shall hold their offices for the term of one year, and shall have the same powers and perform the same duties as the commissioners and trustees before named. And the number of votes to which the stockholders shall be entitled in such elections of commissioners, shall be according to the number of shares such stockholders shall respectively hold of the capital stock of said company; and after the first election no share or shares shall confer a right of voting which shall not have been holden three calendar months previous to the day of election. And stockholders actually resident in the United States of America, and in the federal republic of Central America, and none other, may vote in elections by proxy.

12. Now, therefore, we, the undersigned commissioners and trustees, deeply impressed with the magnitude of the considerations involved in the above instrument, and anxious to promote an object so intimately connected with the commerce of the world and welfare of the human race, do accept of the trust above expressed, which we will execute with fidelity, under an understanding that our liabilities should be confined to the objects stated in the above instrument, and shall not extend further than our own acts.

No. 3.

[Private.]

ALBANY, *October* 6, 1826.

GENTLEMEN: Considering the importance of the grant made by the Central government of America to Mr. Palmer, its binding

nature, and authentic character, (having been attested by Colonel Williams, our minister,) I have considered it my duty to enter into the arrangements which will be shown to you, confidently hoping that you will associate your labors with mine in this great undertaking, and fully believing that no injurious responsibility can accrue, and that great good may be done. Early measures will be taken to procure an act of incorporation from our legislature, and the whole character of the transaction will be free from the taint of speculation.

I am, sincerely, yours,
DE WITT CLINTON.

S. Van Rensselaer,
C. D. Colden,
P. Hone, and
L. Catlin, *esquires*.

No. 4.

Prospectus issued by Aaron H. Palmer, in London, soliciting subscriptions to stock of the Atlantic and Pacific Canal Company.

CANAL FROM THE ATLANTIC TO THE PACIFIC.

Mr. Aaron H. Palmer, of New York, having, after many difficulties, completed, on the 17th of June last, (1826,) a contract with the government of Central America, (Guatemala,) for the performance of this great work, seeks the assistance of British enterprise and British capital in carrying into effect an undertaking which may be truly termed a national one, and the difficulties of which have been much overrated.

The original contract, under the great seal of the republic, is deposited with Messrs. Clayton, Scott, and Clayton, Lincoln's Inn, for the inspection of gentlemen who may feel an interest in the concern; and the substance of it is as follows:

The canal to be cut by the company in the State of Nicaragua shall admit merchant vessels of the largest burden, and is to be open to all nations. The government of the republic of Central America is to fix the amount of the tolls and duties, and is bound to contribute to the most expeditious completion of the enterprise, by permitting the cutting of timber necessary for the works free of expense; by facilitating the surveys, and other preliminary operations; by furnishing the plans, charts, and levellings already made, and in procuring workmen; and is further bound to indemnify the owners of land, farms, and other property through which the canal may pass, for all damages incurred thereby. The company is entitled to receive two-thirds of the tolls and duties to be imposed on all vessels, goods, and produce passing through or en-

ering the canal; the republic is to receive the other third part. The republic reserves the right of redeeming the capital invested in the work, paying interest at 10 per cent.; but the company is entitled to receive one-half of the net proceeds of the canal for the term of seven years after such repayment by the republic. The company is also to have, in all events, the exclusive privilege of the navigation of the canal by steamboats for twenty years after the completion of the work, free of duties, and is authorized to fix the amount to be paid for the freight of cargoes and passengers on board such steamboats, and the rate of compensation for towing vessels through the canal.

The contract has been submitted to the President of the United States, and the Secretaries of State, Treasury, and War, all of whom have expressed their decided approbation of it; and Colonel Williams, the American Minister to the republic of Central America, was mainly instrumental in obtaining the contract, the execution of which by the proper authorities is attested by him.

There are five lines pointed out by Humboldt, as favorable to the formation of a canal across the isthmus; but the line which is contemplated in the contract is about 185 miles; and, though not the shortest, is considered as the best, on account of the excellent harbors which exist at each end, and the great natural advantages afforded by the river St. John, the lake of Nicaragua, and the flatness of the country through which the canal will have to be cut. The river St. John is already navigable for a considerable distance for large vessels, and is navigable for small vessels from the sea into the lake, a distance of about 115 miles; and, at no great expense, might be made navigable the whole distance for merchant vessels of the largest burden. The lake is from three to eight fathoms in depth throughout, and the distance across the lake, from the source of the river St. John to the point at which it is proposed to begin the canal, is about 50 miles, leaving a distance of 21 miles, or thereabouts, to be cut through from the lake to the ocean; and it appears by accurate levels taken by eminent Spanish engineers, that the descent from the lake to the Pacific is 133 feet 11 inches only; the descent from the source of the St. John to its discharge into the Atlantic is considerably less.

The sum which the contractor conceives will be sufficient to complete the work is one million of pounds sterling, of which £200,000 is ready to be subscribed for in the United States as soon as the contractor communicates to his friends there that his plans are organized; and £50,000 is, by the terms of the contract, to be left open for twelve months, to be subscribed for by the citizens of the republic of Central America. This sum, or any part of it which may not be filled up in Guatemala, will also be subscribed for in America; and the following gentlemen in the United States have agreed to act as directors on behalf of the American capitalists:

His excellency De Witt Clinton, governor of the State of New York.

The Hon. Stephen Van Rensselaer, member of Congress for the State of New York.

Morris Robinson, esq., cashier of the Branch Bank of the United States in the city of New York.

The Hon. Edward Livingston, member of Congress, of the State of Louisiana.

Charles J. Catlett, esq., of the District of Columbia.

The remaining £750,000 is proposed to be raised in this country by subscription; and though the directors in America will cordially concur in rendering every assistance in the prosecution of the undertaking, they will not require that any measures which may be determined upon here should be previously communicated to them for approval, relying that the conduct of the concern will be undertaken by gentlemen in England who will command the confidence of the shareholders at large.

The course Mr. Palmer proposes to adopt is, to open a book for the subscription of 7,500 shares, of £100 each, and that a small sum per share be deposited in the hands of Messrs.

, to be applied in such way as a committee of management shall direct, in payment of the immediate expenses.

That an experienced English engineer should be immediately engaged to proceed to Guatemala for the purpose (in conjunction with General Bernard, or such other gentleman as may be selected by Mr. Palmer and the directors in America) of surveying the country, and pointing out the line which they may think most advisable.

General Bernard is the chief of the topographical engineer department of the government of the United States; and Mr. Palmer has reason to believe that the government will permit General Bernard to proceed to Guatemala for the express purpose of assisting in surveying the country and ascertaining the most eligible course for the communication between the two seas.

General Bernard has expressed an opinion that six weeks' residence in the country will be sufficient for that purpose; and Mr. Palmer has also reason to believe that the government of the United States will direct a national schooner to attend himself and the engineers during the survey, and will direct their ambassador to afford every facility and protection to those engaged in the service of the company.

After the American and English engineers have made a general survey, and pointed out the most eligible line, the English engineer will remain as long as he may find necessary to make accurate surveys and estimates; and Mr. Palmer, who is intimately acquainted with the Spanish language, will accompany the engineers, and devote his whole time to procuring information on every point connected with the enterprise, without requiring any remuneration beyond mere reimbursement of the expenses he may have incurred, and shall incur, until the value of his services can be appreciated by the result.

The directors of the company formed in England in 1825, under the title of "The Atlantic and Pacific Canal Company," have reported that the company has been dissolved, or must be dissolved, in consequence of the contract entered into by Mr. Palmer. Mr.

Palmer will be happy to communicate with any gentleman on the subject, either personally or by letter.

LONDON COFFEE-HOUSE,

Ludgate Hill, December 12, 1826.

No. 5.

[From the National Intelligencer of September 25, 1826.]

Canal of Nicaragua.

This title we give, for the sake of brevity, to the projected canal across the isthmus which connects the two Americas through the lake of Nicaragua. The official title of the company, with whom the government of Guatemala has contracted to cut the canal, is "The Central American and United States Atlantic and Pacific Canal Company." The terms of the contract, as represented to us by the general agent, Aaron H. Palmer, esquire, by whose instrumentality the contract was obtained for an American company, are as follows:

"The canal to be opened by the company shall admit vessels of the largest burden possible. The government of the republic of Central America is bound to contribute to the most expeditious completion of the enterprise, by permitting the cutting of timber necessary for the works, by facilitating the surveys, and other preliminary operations; by furnishing the plans, charts, and levelings, already made, and in procuring workmen; and is further bound to indemnify the owners of land, farms, and other property, through which the canal may pass, for all damages incurred thereby. The accounts of the company for all disbursements made in execution of this enterprise are to be audited at the treasury department of said republic every six months, and interest shall then commence thereon, at the rate of ten per cent. per annum.

"The company is entitled to receive two-thirds of the duties imposed on all vessels, goods, and produce, passing through or entering the canal; the republic is to receive the other third part. The company is also entitled to receive one-half of the net proceeds of the canal for the term of seven years after the payment by the republic of the capital invested therein by the company, together with the interest thereon, at the rate of ten per cent. per annum, with the exclusive privilege of the navigation of the canal by steamboats for twenty years after the completion of the canal, free of duties; and is authorized to fix the amount to be paid for the freight of cargoes and passengers on board said steamboats, and the rate of compensation for towing vessels through the canal.

"The navigation of the canal will be common to all friendly and neutral nations, without any exclusive privilege. The government of the republic is bound to keep in the lake of Nicaragua and other

points on the canal the vessels of war which she may judge necessary for the defence and safety thereof.

"The proposals of the company are to have a preference for the supply of the castles and fortifications to be erected on the canal with arms, ammunition, and stores; and also in the contracts for building and equipping vessels of war for the protection of the canal, &c. The company are to reserve five per cent. of the capital stock, to be subscribed for by natives of the republic within one year after opening the books of subscription."

This contract has, we understand, been submitted to the inspection of the President of the United States, and to the Secretaries of State, Treasury, and War departments, all of whom have "expressed their decided approbation of the great object of uniting the two oceans by means of a canal for ship navigation, and their great satisfaction that, if a work of such transcendent importance to the commerce of the world should be executed by any company, that company should be composed of citizens of the United States."

With regard to the importance of such a work, there can be no difference of opinion. Nations might vie with one another for the honor of accomplishing it; and it is an object which, we have no doubt, would have been undertaken by a concert of nations, had so formidable an agency been required to execute the project. Fortunately, however, the obstructions to the construction of a ship canal between the two oceans are not too great for the efforts of associated capitalists to overcome. We have seen a survey of the descent from lake Nicaragua to the Pacific, most accurately made under the direction of the Spanish government, as long ago as the year 1781; for so long ago did that power meditate the enterprise. By that survey, it appears that the descent in fifteen or seventeen miles distance to the Pacific, from the level of the lake to the level of the ocean, is only one hundred and thirty-three feet eleven inches. The descent on this side to the river San Juan is of course not greater. For more particular information, we refer the reader to the following extract from the work of William D. Robinson, who was familiar with the topography of the country, from personal observation:

"In looking over the excellent maps of Melish and Dr. Robinson, recently published, we perceive that the river called San Juan discharges its waters into the Atlantic ocean, in the province of Costa Rica, about the latitude of 10° 45′ north. This noble river has its source in the lake of Nicaragua. The bar at its mouth has been generally stated as not having more than twelve feet water on it. About sixteen years ago, an enterprising Englishman, who casually visited the river, examined the different passages over the bar, and discovered one which, although narrow, would admit a vessel drawing twenty-five feet. It is said that some of the traders to that coast from Honduras are likewise acquainted with the passage just mentioned, but it has never been laid down on any map; and if the Spanish government had been informed of it, they would, conformably to their usual policy, have studiously concealed it. After the bar of San Juan is crossed, there is excellent and safe

anchorage in four and six fathoms of water. It is stated that there are no obstructions to the navigation of the river but what may be easily removed; and, at present, large brigs and schooners sail up the river into the lake. This important fact has been communicated to us by several traders. The waters of the lake, throughout its whole extent, are from three to eight fathoms in depth.

"In the lake are some beautiful islands, which, with the country around its borders, form a romantic and most enchanting scenery. At its western extremity is a small river which communicates with the lake of Leon, distant about eight leagues. From the latter, as well as from Nicaragua, there are some small rivers which flow into the Pacific ocean. The distance from the lake of Leon to the ocean is only about thirteen miles, and from Nicaragua to the gulf of Papagayo, in the Pacific ocean, is only twenty-one miles. The ground between the two lakes and the sea is a dead level. The only inequalities seen are some isolated conical hills, of a volcanic origin. There are two places where a canal could be cut with the greatest facility: the one, from the coast of Nicoya, (or, as it is called in some of the maps, Caldera) to the lake of Leon, a distance of thirteen or fifteen miles; the other, from the gulf of Papagayo to the lake of Nicaragua, a distance of about twenty-one or twenty-five miles. The coast of Nicoya and the gulf of Papagayo are free from rocks and shoals, particularly in the gulf, whose shore is so bold that a frigate may anchor within a few yards of the beach."

Of the practicability of this work, from the foregoing particulars, we presume there is not the least doubt. Much greater obstacles have already been overcome in our own country, than those which present themselves on the two outlets from lake Nicaragua.

The contract above described was ratified, in the Chamber of Representatives, by twenty votes to six, and in the Senate unanimously. Thus authorized, the contract was ratified by the Secretary of Treasury and State of the republic, duly commissioned by the President for that purpose, on the 17th of June last; and the great seal of the republic being affixed to it on the same day, it is now a part of the law of the land. To the activity, intelligence, and persevering zeal of Colonel de Beneski, (a gentleman formerly attached to the Mexican army, and personally held in high respect by the members of the Central American government, most of whom had been his associates and companions in arms,) we learn that the company are chiefly indebted for the successful issue of this important negotiation. Colonel Williams, charge d'affaires of the United States, contributed, in an important degree, to the success of the American company in obtaining the contract. He was present at the execution of it, and it is attested by his signature.

No. 6.

[From the Courrier des Etats-Unis of March 30, 1836.]

CANAL DE NICARAGUA.

Notice sur la Republique du Centre-Amerique et la communication Oceanique par l'isthme de Nicaragua ou de Panama.

L'ancienne capitainerie-generale de Guatemala forme presentement la republique du Centre-Amerique.

Cette partie du nouveau continent, si mal connue des Espagnols, apres trois siecles de domination, et encore moins des autres nations, meme aujourd'hui, *est le point le plus interessant du monde entier* tant par sa situation geographique, que par la richesse et la variete de ses produits.

Ce beau pays est situe entre les deux oceans, le Mexique, et la Colombie. Il se trouve entre le 8e et le 18e degre de latitude septentrionale. Il a plus de 600 lieues de long, sur 40 a 120 lieues de large, de l'ocean Atlantique au Pacifique. On lui donne de 26,000 a 28,000 lieues carrees de superficie, mais sans aucune espece de donnes exactes. Ses cotes sur les deux oceans ont plus de 1,500 lieues de long, et sont couvertes de beaux bois de construction, de teinture, et de marqueterie.

Ses ports sont nombreux, surs, et peu frequentes. Les principaux dans l'ocean Atlantique sont—Matines, Saint-Jean-de-Nicaragua-du-Nord, Blew-Fields, Truxillo, Omoa, Livingston, &c. Dans l'ocean Pacifique, on trouve Punta-Arenas, Saint-Jean-de-Nicaragua-du-Sud, Realejo, Conchagua, Sansonale, Istapa, &c. Plusieurs de ces ports, d'une capacite tres-grande, sont aussi d'une defense facile. La republique du Mexique est privee de ces avantages sur l'ocean des Antilles.

Les Andes, qui longent le Centre-Amerique du sud-est au nord-ouest, y offrent par la variete de leur elevation progressive, et leur temperature, tous les produits des regions tempereres et tropicales. Partout on y trouve de beaux troupeaux de betail, et la fertilite de la terre y est etonnante.

Les mines de fer, de cuivre, d'argent, et d'or, y sont riches et nombreuses. Celles de fer de Metapa fournissent ce metal a la republique; celles d'argent situees dans les Etats de Honduras et de Nicaragua, ainsi que celles d'or de Costa-Rica, donnent de beaux produits, quoique grossierement travaillees jusqu'a present.

Toutes ces richesses ont ete peu ou pas exploitees jusqu'aujourd'hui; a cause de la jalousie ombrageuse du gouvernement Espagnol, qui, connaissant que cette partie de ses possessions d'Amerique en etait le cote faible, et pour ainsi dire la porte, a mis tous ces efforts a conserver ce pays entierement isole de l'Europe. A cet effet, il a neglige la conquete des Indiens sur la cote du nord, qui est restee inhabitee et d'un acces difficile. Toute la population a ete placee sur celle du sud, en face de la Chine. L'interieur du pays a ete couverte de convens, dont les moines surveillaient

la population, et la conservaient soumise à l'Espagne par l'ignorance et la superstition.

Telle était la situation de ces belles contrées depuis leur conquete, en 1524, jusqu'au 15 de Septembre, 1821, qu'elles suivirent le grand movement d'independance du continent Américain.

Influencées par l'exemple des Etats Unis du Nord, dont elles ont adopté depuis les institutions, elles ratifierent leur independance le 21 Novembre, 1824, et formerent une republique federative, qui prit le nom de Republique du Centre-Amerique, et se compose de cinq Etats—Guatemala, Salvador, Honduras, Nicaragua, et Costa-Rica.

L'Etat de Nicaragua est le seul point du nouveau continent ou se trouve entierement interrompue la chaine des Andes, qui parcourt les deux Ameriques. Cette circonstance est d'un immense avantage pour faciliter, par un canal oceanique, les communications entre l'Europe et les cotes occidentales de l'Asie.

C'est en vain que la Russie, par la Perse, et l'Egypte, par l'isthme de Suez, cherchent à s'ouvrir une route vers l'Inde. Ces communications mediterranees ne pourront jamais servir que pour la correspondance, et les marchandises de beaucoup de valeur et de peu de volume. Les autres, d'une utilite plus grande et plus generale, telles que le coton, l'indigo, le sucre, le the, et le cafe, &c., continueront à suivre la route qui leur etait tracee par la decouverte des Caps de Bonne-Esperance et de Horn, malgre la longueur et les dangers de cette navigation, ainsi que la difficulte des relaches.

C'est à l'Amerique, à cette terre si riche d'avenir, situe a l'occident de l'Europe et a l'orient de l'Asie, qu'est reserve de changer la route actuelle du commerce Europeen avec la partie occidentale des cotes du nouveau continent et celles de l'Asie sur le grand ocean.

Deja deux republiques, celles du Centre-Amerique et de la Nouvelle Granade, ont apprecie l'avantage de leur position geographique, en autorisant leurs Gouvernemens respectifs a ouvrir des negociations en Europe pour mettre a execution la communication oceanique; le premier par l'isthme de Nicaragua, la seconde par celui de Panama.

La cessation complete de continuite des Andes dans l'Etat de Nicaragua, appartenant a la republique du Centre-Amerique; la surface unie de son sol, qui est d'une fertilite etonnante; les lacs de Managua et de Nicaragua, dont l'etendue et la profondeur permettent sur ce point de donner au canal les dimensions voulues pour le passage de batimens d'un fort tonnage; la communication de ces lacs entre eux, dont le premier n'est qu'a 6 lieues, et le second qu'a 9 de l'ocean Pacifique, et qui se joignent a l'Atlantique par le fleuve Saint-Jean, forme de l'excedant de leurs eaux; le peu de distance d'une mer a l'autre; la grande quantite de materiaux de construction qu'on y trouve, tels que bois, chaux, terre a brique, ainsi que la co-operation pour l'execution des populations voisines et laborieuses de Costa-Rica et de Honduras; la grande quantite et le bas prix des vivres, tels que viande, froment, legumes; la salubrite en general du pays, dont la variete de temperature permet toutes les cultures des regions temperees et tropi-

cales; la beaute et la securite des ports de Saint-Jean, de Nicaragua, et de Blew-Fields, sur l'Atlantique, de Realejo et de Conchagua sur le Pacifique, lesquelles pourraient servir sur les deux oceans d'embouchure au canal, et contenir une grande quantite des batimens sans en gener le passage; telle sont les avantages que presente l'isthme de Nicaragua, pour y etablir la junction des deux oceans, de preference a tout autre point du continent Americain, indique par M. de Humboldt.

L'isthme de Panama avait d'abord appele l'attention pour y executer la communication oceanique; mais l'elevation que sur ce point conservent encore les Andes, dont la base est de roche, ainsi qu'on l'observe le long de la riviere de Chagres; le peu d'eau et la rapidite du courant de cette riviere; la nature du terrain; son elevation au-dessus du niveau de la mer, et sa pente assez rapide vers les deux oceans; la population peu nombreuse, ainsi que les vivres dans la province de Panama et de Veragua; le peu de profondeur de l'eau dans le golfe de Panama, qui force les batimens a se tenir a une grande distance de la ville, a cause du flux des mares, qui est de 10 a 12 pieds dans ces parages, exigeraient la prolongation du canal de deux a trois milles au moins dans la mer, et la construction d'un port artificial comme celui de Cherbourg, en France; telles sont les difficultes immenses et exorbitamment dispendieuses que la nature presente pour ouvrir la communication oceanique par l'isthme de Panama.

Ainsi que l'isthme de Suez, celui de Panama ne parait convenable qu'a l'etablissement d'un chemin de fer, plutot dans un interet local que dans celui de l'Europe et de l'Asie, et meme de l'Amerique, dont le commerce continuerait de suivre la route des Caps de Bonne-Esperance et de Horn, malgre la longueur et les dangers de leur navigation, si fatiguante pour la coque et le greement des batimens, ainsi que pour les equipages. On y serait force par la difficulte de combiner avec exactitude le transport des marchandises dans les deux oceans, par les frais qu'entrainerait leur transbord et leur transit; par les droits de commission et de magasinage; par la perte de temps et les avaries occasionees par toutes ces operations; et, enfin, par la necessite absolue d'avoir recours a ses consignataires.

Ces obstacles, ces depenses, ces pertes de tems pour les commerce, disparaissent devant une communication oceanique par l'isthme de Nicaragua, qui permettrait aux batimens partant de l'Europe de remettre a leur destination leurs cargaisons, telles qu'ils les auraient recues a leur depart.

Les avantage d'une communication oceanique, au travers du nouveau continent, sont incalculables. Cette entreprise est reclamee par la civilisation actuelle dans l'interet d'interet de l'humanite. Son execution interesse eminemment l'homme d'etat, le physicien, le geographe, et le commercant. Elle aura pour premieres consequences pour le monde entier, independamment des immenses avantages reserves au Centre-Amerique, de—

1°. Resoudre le grande probleme de communication oceanique,

...ple par Colomb, dans ses lettres a Charles V., le Secret du Detroit.

2°. Etablir dans l'Etat de Nicaragua, au centre du nouveau monde, un grand foyer d'ordre, de lumieres, et de prosperite, dont l'influence se ferait sentir sur tout le contenent Americain, ainsi que sur le commerce entre l'Europe, l'Asie, et l'Amerique.

3°. Consequence pour la civilisation de cette bienfaisante influence.

4°. Resultats politiques et commerciaux de cette facilite de communications avec l'Asie.

5°. Influence de la civilisation sur la cote occidentale de l'Amerique, sur la Polynesie, la Chine, et le Japon, dont la langue de terre, qui separe les deux oceans, est depuis des siecles le boulevard de l'independance.—(*Humboldt*, liv. 1er, ch. 2.)

6°. Avantages pour la Russie d'une communication oceanique par le continent Americain, qui rapprocherait d'Europe de plus de 2,000 lieues, et, par une route facile et sans dangers, ses possessions de Nootka-Sund, dans la Russie-Americaine.—(*Humboldt*, liv. 1er, ch. 2.)

7°. Eviter au commerce la circumnavigation lente et couteuse des Caps de Bonne-Esperance et do Horn avec l'Inde, du cote occidental de l'Amerique, la Polynesie, la Chine, et le Japon.—(*Humboldt*, liv. 1er, ch. 2.)

8°. Augmentation du commerce de l'Europe et de l'Amerique avec ces contrees, causee par la facilitate des communications.

9°. Exploitation des riches mines de fer, de cuivre, d'argent, d'or, &c. du Centre-Amerique.

10°. Grand depot des produits de l'Inde, des Philippines, de la Chine, et du Japon, ainsi que de l'Amerique et de l'Europe, sur un point central universal.

11°. Le commerce des pelleteries des cotes nord-ouest de l'Amerique, rendu plus facile avec l'Europe et la Chine.

12°. Faciliter la peche de la baleine et du cachelot, d'une si haute importance toujours croissante pour le commerce qui est oblige, pour s'y livrer dans ces parages, de faire une circumnavigation de plus de 5,000 lieues marines.—(*Humboldt*, liv. &c. ch. 10.)

13°. Facilites que presente la situation geographique de l'Etat de Nicaragua, pour y former sur les cotes des etablissemens pour la peche de la baleine et du cachelot.

14°. Grands avantages que presente l'Etat de Nicaragua, et meme toute la republique du Centre-Amerique, pour y former des etablissemens d'agriculture pour les produits des tropiques, qui peuvent y etre facilement cultives par les Indiens; ce qui est d'un grand avantage depuis la liberte accordee, ou qui doit etre accordee, aux negres dans les colonies Europeennes.

15°. Importance de la situation geographique du Centre Amerique, baignee par les deux oceans, et presque a la meme distance de Canton et de Calcutta que de Bordeaux et de Hambourg.

16°. Securites, guarantes, et facilites procurees au commerce par

l'établissement d'un grand depot des produits de l'Europe, de l'Asie, et de l'Amerique, au centre du nouveau continent.

17°. Des petits batimens pourraient se rendre de l'Europe dans l'ocean Pacifique, et sur les cotes de l'Asie, par cette nouvelle route, presqu'entierement tracée entre les tropiques, et par laquelle ils n'auraient presque pas de dangers a courir apres avoir quitté les cotes de l'Europe. Cette facilité de communications aurait une grande influence sur le commerce avec l'Amerique, la Polynesie et l'Asie, independamment de l'influence pour la civilisation de ces dernieres contrees.

18°. A ces avantages, il faut encore ajouter ceux de faire facilement des vivres en traversant le continent Americain, sans perte de temps, et a beaucoup meilleur marché qu'en Europe, ce qui, a tonnage egal, augmenterait la quantité de marchandises que les batimens qui suivraient cette route pourraient prendre, en utilisant ainsi la place occupée dans la cale par les provisions necessaires a un long voyage, pendant lequel, au lieu relaches peu hospitalieres et tres dispendieuse des Caps de Bonne-Esperance et de Sainte-Helene, on rencontre sur la nouvelle route celles des Acores, des Canaries, des iles du Cap Vert, des Antilles, du Centre-Amerique, d'Otaiti, des Philippines, &c. Il y en a encore beaucoup d'autres dans les iles de la Polynesie, habités par des peuples generalement inoffensifs, visités seulement par des batimens qui se livrent a la peche de la baleine ou au commerce de pelleteries.

19°. Le canal de Nicaragua, qui serait un bien meilleur point de relache que le Cap de Bonne-Esperance et l'ile de Saint-Helene, donnerait la facilité de former des etablissemens dans les nombreuses iles de la Polynesie, et sur la route de l'Amerique a l'Asie, tant pour la protection du commerce que pour celle de la peche de la baleine.

20°. Les lacs de Nicaragua et de Managua offrent aussi le grand avantage de ports immenses et surs dans le centre de la Terre-Ferme.

21°. Enfin, l'execution du canal de Nicaragua rapprochera les peuples les plus eloignes les uns des autres, et les unira par des liens indissolubles fondés sur des interets mutuels. La revolution que la communication oceanique causera dans le commerce egalera au moins celle qui eut lieu par la découverte du Cap de Bonne-Esperance.

La republique du Centre-Amerique a posé les bases sur lesquelles doit etre fait le contrat pour l'ouverture de la communication oceanique. Les suretés et guaranties que donne le Centre-Amerique sont aussi completes que possible, d'une valeur beaucoup plus considerable que celle due capital necessaire pour l'ouverture du canal de Nicaragua, *entreprise aussi facile dans son execution qu'immense dans ses resultats.*

No. 7.

[From the National Gazette of March 17, 1836.]

The Central States of America.

The Central States of America are, viz: Guatemala, San Salvador, Honduras, Nicaragua, and Costa Rica.

They extend from the latitude of 8° north to 18° north.

These States owe their union to the wisdom and bravery of General Francis Morasan, who, by consummate prudence as well as by victory, overcame the turbulent spirit and conduct which unhappily pervaded a great mass of their citizens for several years; and who, finally, effected their independence on the 1st of July, 1823.

The constitution which has been adopted is very similar to that of the United States of North America.

The seat of the general government is at San Salvador, a city in the federal district of the same name, near the Pacific ocean.

The present president is General Francis Morasan, who was elected in the year 1834, a second time, for a term of four years, to that high office; while his good fortune hitherto, with such moderation and sacred respect for the institutions of the country, promises a prosperous period to his administration. Indeed, it is confidently predicted that the internal troubles of Central America have terminated forever.

These dissensions have, however, greatly retarded the prosperity of Nicaragua and San Salvador, but the other three States are rapidly advancing in the career of good government, industry, and wealth, especially that of Guatemala, which, from the unremitting attention and powerful talents of its chief, Mr. Mariano Galves, in conjunction with the tranquillity it has for many years enjoyed, and the greater intelligence of its principal inhabitants, is more forward in the race of improvement. In this State, the Spanish laws have been entirely abolished, and the code introduced by Mr. Livingston in Louisiana has been substituted in their stead. Education in particular is fostered by all practicable means, while the greatest security and good faith are observable in all the transactions of the government. The healthiness and fertility of the province, and the temperature of the climate which prevails at a short distance from the coast, offer the most favorable inducements to emigration.

A central, but not very elevated ridge, connecting the Andes with the rugged mountains of the northern continent, runs through these States, from whence various navigable rivers have their sources, and discharge their waters into the bays of Campeachy and Honduras, the Caribbean sea, and the Pacific ocean.

The seasons are distinguished by *dry* and *rainy* months, the latter prevailing from May to October. Volcanoes are numerous, and earthquakes are frequent. But the respective provinces may nevertheless be characterized as highly salubrious, in many places beautified with woods of excellent quality, and with vales which

afford the richest pastures. Provisions of all kinds abound, and household expenses are consequently very low.

The principal ports of the federation are, in the bay of Honduras, Isabel, Omoa, and Truxillo; in the Caribbean sea, San Juan de Nicaragua, Matina, and Bocatoro; and in the Pacific ocean, Calderas, el Realejo, la Union, Libertad, Acajutla, and Istapa.

The staple exports of the several States are gold and silver, indigo, cochineal, sarsaparilla, hides, balsam, mahogany, log wood, and various woods celebrated for their brilliant dyes. No section of the vast hemisphere of the new world has such comparative abundance of valuable exports, which, by the increasing industry of the inhabitants, now nearly equal the imports.

These States have scarcely any foreign debt, and the custom-house duties are exceedingly moderate.

The population of the Central States is little short of two millions, and is almost without any of the negro race. They are also happily distinguished by an entire absence of that religious fanaticism which so unfortunately pervades a great mass of the people in the neighboring republics. Religious toleration is expressly provided for by their constitution, and is a principle inherent in the feelings of all classes of persons. There are no bishops in the Central States; the monkish orders have been wholly abolished; and, as to the few nunneries which remain, the members cannot be compelled to stay in them against their inclination.

For this concise description of these provinces, I am principally indebted to the kindness of Colonel Don Juan Galindo, a gentleman gifted with deep penetration and highly cultivated talents, as well as with frankness and liberality of disposition, who is deputed to England in a diplomatic capacity, and who, among other important functions, is charged with the high responsibility of sending intelligent and moral teachers of the English language to the Central States.

This part of his mission being so closely allied to my own feelings and inquiries, and prizing, as I do, the high honor which has been paid to the British nation, by selecting their language as the vehicle for extending science and literature among the youth of these improving territories, I may be pardoned the expression of the fulness of my gratitude for this distinction shown to my country.

As connected, then, with this important object, I proceed to state that thirty masters have been engaged to proceed to the Central States, selected by the careful agency and experience of Mons. Louis F. de Pourquet, of Tavistock street, and under the authority and approbation of Colonel Galindo, upon the following conditions, viz:

1. Each master to be settled in a town of the Union, with a salary of £40 per annum, to be paid either quarterly, half-yearly, or annually, as he may desire; and the same to be guarantied to each of them for four years.

2. A house to be provided for the master, rent free, and furnished.

3. *Ten* scholars of the poorer class to be taught in each establishment gratis, in reading, writing, and speaking the English lan-

guage with purity, and also, in arithmetic and geography, by each master; who shall likewise be allowed to take an unlimited number of boarders and day-scholars, at a quarterage to be agreed upon with the parents of the pupils.

4. During the continuance of the voyage, each master to be provided with comfortable accommodation and good diet on board.

5. Each master's salary to commence from the date of appointment by the authorities.

6. Each master to be at liberty to resign his appointment, and to return to England, or remain in the Union, at his pleasure.

7. And, as these conditions are accepted in the purest good faith of all the parties, it is expected and intended that honor and probity shall be the constant guide of their conduct.

Such are the measures now taken to extend the knowledge of the English language and literature, which, it may reasonably be hoped, will assist to perpetuate and exalt the name of Englishman in those remote regions; and, eventually, to enlarge such social relations between Great Britain and the Central States as from mutual benefit and friendly intercourse will naturally arise.

NICHOLAS CARLISLE,
Secretarian to the Antiquarian Society.

Somerset Place, *London, January* 13, 1836.

ISTHMUS OF PANAMA.

[Extracted from Lloyd's Report to the Royal Geographical Society in 1831.]

The isthmus of Panama, or Darien, is, in its narrowest dimensions, opposite to Panama, about 30 miles across.

Its whole extent is not comprised within the Spanish American province; the Mandingo Indians, to the northeast, maintaining their independence to the present time.

The cordillera, or great chain of mountains which traverses the entire continent of America, is twice broken in this isthmus.

The northern cordillera, of which the Rocky mountains may be regarded as a part, ceases in Nicaragua, but again rears its lofty summits in Veragua, where it is crowned with an extensive plain called La Mesa.

In the eastern part of the province of Veragua, it breaks into detached mountains of considerable height, and of the most abrupt and ragged formation; thence, proceeding still to the eastward, innumerable conical mountains lift their heads three or four hundred feet high, having bases surrounded by plains and savannahs.

Finally, about Chagres on the one side, and Chorrera on the other, these also disappear, and the country, for a few miles, becomes almost uninterruptedly low and flat. Again those sugar-loaf mountains rise, and, becoming connected, form a small cordillera, running, from about opposite Porto Bello, to the bay of Mandingo, where is the second break. The land then continues

low through the provinces of Darien and Choco. It is watered by numerous rivers; those on the north side running to the Gulf of Uraba or Darien, and on the south to that of San Miguel; beyond which the cordillera again rises on an extended scale, and enters South America.

The general direction of the mountains in the vicinity of Panama is northeast and southwest. Elsewhere they vary, maintaining the same realation to the line of coast, though not always parallel to it. They are generally covered with almost impenetrable forests, growing on a fruitful soil of great depth.

The prevailing rock is limestone. Besides this, flint, chalcedony, jasper, and iron stone are found in the interior; and, near Gatun, on the Chagres, a very fine fire stone, for the construction of kilns and furnaces; clay for bricks is abundant, and sand to form cement. In a word, (says Mr. Lloyd, the author from whom this geological description is extracted,) no part of the world, perhaps, presents a greater variety of building materials, or more facility in procuring them, than the isthmus of Panama.

THE FOREST.

Of 97 varieties of trees, the description given by the same author, of the following twenty-five varieties, demonstrates that no deficiency of other materials, either for railroads or canals, will be found to exist along the southern route of communication between the Atlantic and Pacific.

1. *Amarillo.*—A yellow wood; hard, tough, fine grained, and very durable; has no heart; is in great quantities, used for furniture, house building, &c. *Excellent.*

2. *Amarillo de fruta.*—Bearing a fruit; is yellowish white, with a long grain; tough, and rather hard; is very common; grows to the size of not more than two feet diameter; the heart is of the same color; is much used in house building.

3. *Amarillo curabasuel.*—A green wood; hard and brittle; grows to a very large size, and is common; used for building, and making very large tables.

4. *Algarobo.*—One of the most excellent woods known; very hard and tough; reddish brown, with streaks; grows to a large size, and common; used for marine gun carriages, &c.; called in Jamaica, *mogo.*

5. *Aromo.*—A soft, long grained, shiny, whitish wood; very light and tough; grows to a good size, and common.

6. *Cocobolo amarillo.*—Like rose-wood; very tough and hard; seldom grows to more than one foot diameter, but occasionally larger; has a fragrant smell, with dark brown streaks—I think something like zebra wood; is very common in the high dry lands.

7. *Cocobolo prieto.*—A very tough, hard wood, of a beautiful figured grain; (I think like rosewood;) grows to the size of about three feet diameter, but generally smaller; is very plentiful; has a very fragrant smell when green; used more for carpentry than cabinet work.

8. *Cacique, or king of woods.*—One of the finest and most durable woods of South America; whitish yellow; hard, tough, and long grained; grows to a large size; is common, and much used for building in the ground or water.

9. *Conejo colorado.*—Yellowish; very close, fine grain, like holly, but harder; grows to a good size.

10. *Cedro real amargo.*—The finest cedar of the country; of a strong fragrant smell, and long grain; used for many purposes in carpentry and boat and canoe building; grows to five or six feet diameter, and is very common.

11. *Caoba.*—Bastard mahogany; not very common in the vicinity of Panama, but brought in immense quantities in canoes from the coast, where it is very abundant, and grows to an immense size.

12. *Corotu prieto.*—Soft and porous, like walnut; long grained; grows to an enormous size; is generally used next in preference to cedar for the largest bongs and canoes, and is very abundant in all parts.

13. *Carati.*—Hard, close grain; brownish, tough, heavy; grows to the size of one foot six inches diameter, and is very common.

14. *Ciquarri.*—A fine wood; hardish and tough; something like bastard mahogany, but a more shiny grain.

15. *Espino colorado.*—Like walnut tree; a dark wood, nearly the color of cedar, but much harder, and a close grain; grows to about three feet diameter; beautiful wood for boat building.

16. *Espabé mulato.*—A softish, long grained, close, tough, very knotty and refractory wood, but very lasting; grows to an immense size, and used universally for flooring and wainscoting; is very common.

17. *Espabé prieto.*—One of the common woods of the country; I think something like elm; grows to the size of five feet diameter, and is used in every branch of house building; it has rather a rough grain to work.

18. *Guallacan.*—Lignum vitæ; very common, close grained, hard, heavy, and tough; works exceedingly well when rather green; grows to the size of from four to five feet diameter, and is much used for gun carriages, wheels, &c.

19. *Guachapali.*—Soft, open grain, like walnut; brownish, tough, and rather heavy; grows to four or five feet diameter; is much used for canoes and house building.

20. *Moro*—(fustic.)—Yellow, with a long fine grain; hard and tough; grows to the size of three feet six inches diameter; a fine dye; very common in the woods on the banks of the river Chagres; has a peculiar smell.

21. *Mangle*—(mangrove?)—Close grain, like birch; reddish brown, and very hard; is much used as timber for vessels; is very common throughout the low and swampy lands near the coast.

22. *Nispero.*—Hard, close grain; yellowish white, tough, and light; grows to about two feet diameter; is common, and used for house building.

23. *Quajado.*—Hard, close, very tough, and untractable grain; a

most excellent wood; grows to the size of two feet diameter; indestructible; common, and much used in house building.

24. *Quira.*—A tough wood; very hard, close grained, and heavy; of different colors, from light brown to very dark; has an agreeable odor when newly cut; grows to the size of three feet six inches diameter, (but generally from one foot to two feet six inches,) and very high; it is plentiful, and much used in house building.

25. *Roble.*—Whitish gray, and long grained, like deal; grows to a large size, and very common; much used in house building, but particularly by the Indians for paddles for their canoes.

For the sustenance of laborers no difficulty would be encountered where rice and Indian corn are the staple productions of agriculture, and deer, wild turkeys, pheasants, pigeons, ducks, and droves of wild hogs abound in the adjacent forests.

The isthmus is famed for snakes and reptiles; but Mr. Lloyd met with but one or two in a period of many months.

CLIMATE.

The seasons are not divided, as in the temperate and northern climates, into winter and summer, or cold and hot, but into wet and dry. The first commences about the end of December, and lasts three months; the latter continues from April to December. The quantity of rain which thus falls far exceeds that of more northern or southern latitudes.

Where the country is level to any extent, and has been cleared of its wood, a great difference is perceptible. At Panama the following alternations are observable:

In April the weather becomes cloudy about noon, but after drizzling for half an hour clears up.

In May, from 9 to 11, it is dull, with slight rain; the afternoons being still fine. As the season advances, the rain gradually increases; and is incessant throughout July, August, September, and October. In November the nights are always wet and cloudy, but through the day the sky begins to break. December brings a further improvement. And in January, February, and March, a shower of rain is as uncommon as a gleam of sunshine at the other season of the year.

The temperature and salubrity of the climate also vary in different places:

At Panama the thermometer, in the rainy season, does not rise higher at night than 82°; nor in the day than 87°, the winds are variable and cool. No stagnation occurs in the atmosphere, nor consequent epidemic sickness.

In summer, or the dry season, the temperature rises to 90° and 93°; but, at night, the land winds are cool, coming from the adjacent mountain.

The family of a British consul resided four years in Panama without an hour's sickness; and Mr. Lloyd and his companion were seventeen months in the country, exposed to the utmost rigor of sun and rain, with entire impunity.

Labor.

The writer from whose notes the chief of these details have been abstracted, says the population, though strong and enduring under occasional fatigue, are nowhere industrious. Their indolence he ascribes to their climate in some degree, but chiefly to the extreme fertility of the soil, and the consequent ease with which subsistence is obtained. He is of opinion, however, that this would constitute no insuperable obstacle to the construction of a work of undoubted public utility, undertaken with competent resources.

There are, within the province of Los Santos, several regiments of militia, formed of the poorer classes of people and Indians, who are excellent workmen in felling timber and clearing ground, and particularly apt in acquiring any mechanical art. Their habits are simple, their dress of the cheapest description, and the same throughout the year: their sustenance a piece of dried beef, a few plantains, and some rice. On this they live from youth to age, with a skin to sleep and a block to sit upon. Shoes are with them an article of luxury; their dress a check or brown Holland shirt, and a pair of drawers reaching to the knee, which are cast off when at work. Their common wages are from two to three reals a day, (from one shilling to one and sixpence, or from 16 to 25 cents,) with their meals, which, as they are fed, may be computed at four pence (or eight cents) more.

These men, there is no doubt, the government (under particular circumstances) would gladly place at the disposal of a company, with individuals to command and keep them in order; and, in one instance, the author says this has been already offered, to the extent of a thousand men.

Trade.

The commerce of the isthmus, when Mr. Lloyd wrote, he represents to have been at a very low ebb. On the Atlantic shore it is maintained with Jamaica by a British man-of-war, which sails every month, between the 20th and 28th, for the express purpose of carrying letters and specie; with Carthagena, by government vessels, twice a month; and with the same and a few other points by independent traders, which bring freights to Chagres and exchange them. On the Pacific it embraces all parts of the coast, both north and south, which find it their interest to communicate with Europe in this way.

The expense of conveying specie across the isthmus to be embarked at Chagres is as follows: a mule will carry five thousand dollars or ounces, and its hire from Panama to Cruces is six dollars; the municipal duty is one dollar, and another called *piso* is two reals. From Cruces to Chagres the freight for the same sum is one and a half dollar; the porterage at Chagres is as much more; and the whole charge on it is thus ten dollars two reals, besides a transit duty of three per cent. on silver and one per cent. on gold. The return trade in goods is at the following rates:

The water carriage from Chagres to Cruces is two dollars the bale, and warehouse room in Cruces two reals more. Thence the goods are carried to Panama, either on mules, or by natives on their shoulders, as the case may be. If the packages are heavy, but strong and compact, mules are employed; but if liable to breakage, or of inconvenient shape for passing carelessly along narrow lanes; and up and down steep acclivities, men are considered the most trustworthy and careful animals. The hire of a mule is, according to the burden and measure, from four to six dollars; and of a porter, from six dollars upwards, by the same rule. On the arrival of goods at Panama, they are immediately lodged in the custom-house; and if for exportation, pay a duty of two per cent.; if for home consumption, it is according to the article. And to all these expenses must be added about four dollars on the bale, for extra packing to defend from rain; making in all from 10 to 12 dollars.

In the year 1825 the following vessels were entered at the port of Chagres, exclusive of men of war, packets, and small coasters, viz: one large ship from Bordeaux; seven brigs from Havre-de-Grace; twenty-one schooners, (chiefly British,) from the West India islands; six schooners from the United States; and three from Carthagena. In 1828, these numbers had diminished to eleven schooners from the West Indies, four from Carthagena, and five from the United States, without any French whatever; and it is not believed that the trade has since much revived.

In the same years the entries at Panama were respectively seventeen and twenty-four vessels; the lesser number, on the one side, corresponding to the greater number on the other, and *vice versa*. This would seem to indicate that the whole transit might, with patience and perseverance, be considerably improved; but the spirit of commercial enterprise, which in 1825 was too rash, has ever since been altogether as desponding. The improvement is chiefly exemplified in the trade with Guayaquil, which exhibits only one entry in 1825, and no fewer than eleven in 1828. The passage from Callao to Panama takes usually from nine to twelve days; from Panama to Chagres it occupies three; and from Chagres to Jamaica, six to ten.

[Extract from Thompson's Guatemala.]

June 3, 1825.—I was introduced to-day, by Mr. Bayley, the agent of Messrs. Barclay & Co., to Padre Dighero, deputy for Antigua, or ancient city of Guatemala; he was a canon of Guatemala Vieja, and known to be a man of great scientific research, and, amongst other articles of valuable information, he gave me a sketch of a road which it was proposed to form between the city of Santiago and the south sea; the distance being about eighty-six miles. I understood from Mr. Bayley that the plan was likely to be carried into effect, by a company about to be formed by the house he re-

presented, he also told me that there was every probability that the same firm would get the privilege of opening a water communication between the two seas at the lake of Nicaragua. Although the carrying into effect of the latter object might, in some degree, annul the utility of the former, yet I was glad to find they were likely to take effect at all, and, chiefly, that they would be carried into execution by British energy and British capital. The unfortunate money crisis, it is well remembered, put a stop to these plans, and has nearly paralyzed every other scheme of advantage or emolument in South America; good or bad, they have all been condemned alike; men lost the faculty of reasoning, so great was their terror; and, in proportion as the tide of public opinion ran strong and buoyant in favor of those speculations, so it, all at once, ebbed down into a state of stagnant imbecility.

In the meantime, I lament to say that, as far as regards the country of which I am writing, its importance, however overlooked by British capitalists, has attracted the serious attention of other European nations. His majesty the king of the Netherlands, with a view of patronising and extending a commercial intercourse with it, has subscribed half a million of guilders for the formation of a joint stock company; the capital consists of a million, so that his majesty is proprietor of half of the concern. We need not question that it will enjoy the royal encouragement or that of his ministers. It is to be hoped, however, that the Dutch will not exact the exclusive privilege of the passage, but that it will become open to all nations; although they might reasonably expect to derive some specific advantages on account of transit dues, for having carried the plan into execution.

For the satisfaction of those who may yet feel an interest in this undertaking, although the object can now no longer be of any very particular consequence to ourselves, I subjoin a few observations, which, after the most diligent inquiries of parties best calculated to give me good information on the subject, I was able to collect. Without adverting to even some general remarks on the feasibility of establishing a water communication between the Atlantic and the Pacific, by enumerating the points whereby such plan is presumed capable of being effected,* I shall here confine myself to the proceedings which have been adopted by individuals of different countries, and by the Guatemalian government, for carrying into execution the desired object, at the point in question.

It is an important feature in the history of this republic, that she has been the first (and, indeed, the only one of them all) that has taken any decided steps in the matter. Most writers have considered the river San Juan as one of the most advantageous as well as most likely points for establishing the communication alluded to. The Guatemalian government have, naturally, been no less impressed with that opinion; and the following particulars will show

* These points are suggested, and their respective feasibilities explained, in my [Thompson's] Dictionary of America and West Indies, vol. III., p. 207.

in what manner they have met the propositions which have been made to them, as well as the specific objects which they entertain in carrying the plan into execution.

There were, at this time, two companies formed in England for the general purposes of effecting, by steam navigation or otherwise, a water communication between the two oceans; but the only proposals that had been made to the government by British merchants were proffered by the respectable firm which I have above mentioned. The purport of those proposals, bearing date the 18th September, 1824, was to form a navigable communication by means of the lake of Nicaragua and the river San Juan, without any expense to the government, provided the latter would give the projectors every necessary assistance. On the 2d of February, 1825, other propositions were made to the government by some merchants of the United States of North America, and signed by Colonel Charles Bourke and Mr. Matthew Llanos. They observe, that "on the strength of statements which manifested the practicability of the enterprise, they proceeded to New York in the month of March, 1824, for the purpose of forming a company for defraying the expenses of such a work; that, having formed the company, which consisted of some of the strongest [that was their expression] houses of the northern federation, they returned to the central republic with an armed brig, on board of which they brought engineers to level the grounds and survey the lake of Nicaragua and St. John's river." The letter continues: "We, having despatched the said brig to her destination at the end of last December, and being now about to proceed by land in order to examine the local situations of the territory, pray this government, in consideration of the advances already made, and the advantageous nature of the subjoined propositions, (than which, we believe, none more favorable can be offered to this republic,) to secure to us their realization, by granting the exclusive privileges which we solicit." The terms proposed to give to the government, for the exclusive privilege of navigation, twenty per cent. on the annual product of the toll to be paid by vessels passing through the canal, and after the expiration of the term, [the period is not mentioned] the canal to become the exclusive property of the government. The projectors required to have: "1st, an exclusive privilege for the purpose; 2d, an exclusive privilege for navigation by steamboats on the rivers, and on the waters of the three provinces, as far as the lake where the said canal is to be opened; 3d, permission to cut wood in the said province; 4th, exemption from duty on the introduction of goods on account of the company, until the canal be completed."

Of the above propositions, on the part of Mr. Barclay & Co., and of the merchants of the United States, no specific notice appears to have been taken; but, on the 16th of June, 1825, the Congress passed a decree which obtained the approbation of the Senate on the 11th of July, and was confirmed by the executive on the 12th of that month, which promises the sanction and assistance of the State to any parties who would undertake the project, and to recognise, as a public debt, the money expended in the execution

of it; the passage dues to be applied to paying off the capital sunk in its opening, and to satisfying the interest thereon; deducting, first, the expenses which the repairs of the said canal shall require, the cost of collecting the dues, and of a garrison for its defence. The navigation to be free to all nations, friendly or neutral, without any privilege or exclusion.

On the 1st of August, 1825, the executive extended the time for receiving proposals to six months longer. The consequence has been that the Dutch, as I have before stated, stepped in and possessed themselves of the undertaking. When I left the republic, I felt assured that it would have been carried into execution by the British; and I cannot suppress my mortification that foreigners should have the exclusive honor, to say nothing of the advantage, of so great an enterprise; for it is one which can be but *once* effected amidst the noble achievements of eventful time.

* * * * * * * *

I collected four charts respecting the lake of Nicaragua and the river San Juan. Two of these were, I discovered, very incorrect; but one of them gave the best plan of the port of San Juan, whilst the other afforded the most correct notion of the settlements and territory on the western side of the lake; a third, which was copied by permission of the government from an original in the Congress, was, in a general point of view, that which can best be depended on. I obtained also a table of the levels taken between the western side of the lake and the South sea, which sets at rest the question as to the respective heights of the bodies of water which it is wished to communicate.* It shows that the lake is forty-four yards (Spanish) and a fraction above the level of the South sea.

That the San Juan is navigable from the port to the interior of the lake for craft drawing three or four feet water, at all times in the year, there can be no reason to doubt. It also appears clear that it can be ascended in two or three days more than is occupied in descending it. For thirty or thirty-five leagues up, it is navigable for vessels drawing from ten to twelve feet water. It is near the fort of San Juan that the difficulties arise, on account of the cataracts; and here it is that the skill of the Dutch engineer may be exercised in making collateral cuts or canals to provide the depth of water, at all seasons, that may be required for the regular navigation; in the lake itself, there is depth of water for vessels of any class. In the map will be seen the exact spot where it was intended to open the communication with the South sea. This is not by the lake of Leon, but on the southwestern side of the lake of Nicaragua, where the country is level and admirably adapted for the purpose. The reader will not have forgotten my travelling companion Don Simon; he was a native of this part, and, as my stay in the country did not allow me to visit it, I was happy in being able to collect from him much information concerning it.

The city of Realejo,† when the chart was taken, contained about

*See this table, beginning on page 395.
†The port of Leon, on the Pacific ocean.

500 houses; it does not now contain, at the most, more than 120, and is no city. It is said that, at the back of that town, the Spaniards used to build vessels of four hundred tons. However this might have been the case once, it is certain that they cannot now build vessels there, to any advantage, of more than 70 or 80 tons, as there is not depth of water to bring them down to the Xaguey, or great port where the large vessels lie; but about three miles farther down is a place called the Vaca Borracha, where vessels drawing twelve feet water can lie, making fast to the trees on both sides. The tide rises twelve feet up at the town; and docks could be made there for good sized vessels; but the difficulty would be to get them down to the Xaguey. I procured a plan and description of the port.

The city of Leon contains at least 38,000 inhabitants, and is next in rank to Santiago de Gautemala.

Table of levels between the lake of Nicaragua and the South sea.

Table of three hundred and forty-seven levels, taken by the water-level, at the average distance of about one hundred yards each, between the South sea and the lake of Nicaragua, beginning at the former and ending at the latter; showing the greatest height of the lake as compared with the descents and heights of land between the two points in question; the same being executed agreeably to the directions of the captain general of the kingdom of Gautemala, Don Mathias de Galvez.

		Descents of land below the lake.			Heights of land above the lake.		
Number of levels.	Distance, in yards, at which each level was taken.	Feet.	Inches.	Lines.	Feet.	Inches.	Lines.
1	100	4	5	5			
2	100	4	2				
3	100		11	6			
4	100					1	
5	100	2	4				
6	100				9	6	4
7	100	4	3	3			
8	100	3	3	4			
9	100						4
10	100		5				
11	100				2	5	4
12	100					9	
13	100		2	3			
14	100	1	9	2			
15	100		7	9			
16	100					2	4
17	100	1	4				
18	100					1	8
19	100				2	8	1
20	75		6	10			
21	100				1	3	2
22	100	3	3				
23	49					4	7
24	75		10	3			
25	100			6			
26	100					11	10
27	100				1	10	3
28	100				3	6	6
29	100				2	9	2
30	100						6
31	100					2	2
32	100						
33	100	1					
34	100	1	7				
35	100		10	7			
36	100		9				
37	100		11				
38	100	1	4	6			
39	100		7				
40	100		7	4			
41	100		5				
42	100			8			
43	100		6				
44	100	1	1	10			
45	100		10				
46	100	1	5	7			
47	100	1	4	8			
48	100		10				
49	100	1	1				
				9			

TABLE—Continued.

Number of levels.	Distance, in yards, at which each level was taken.	Descents of land below the lake. Feet.	Inches.	Lines.	Heights of land above the lake. Feet.	Inches.	Lines.
50	100	1	1	.....	.....	.....	.....
51	100	1	8	.....	.....	.....	.....
52	100	.....	2	10	.....	.....	.....
53	100	.....	1	.....	.....	.....	.....
54	100	.....	1	1	.....	.....	.....
55	100	1	6	.....	.....	.....	.....
56	100	1	5	.....	.....	.....	.....
57	100	.....	10	.....	.....	.....	.....
58	100	.....	.....	.....	.....	.....	3
59	100	2	.....	.....	.....	.....	.....
60	100	3	7	6	.....	.....	.....
61	100	2	2	.....	.....	.....	.....
62	115	.....	.....	.....	6	4	4
63	132	1	4	4	.....	.....	.....
64	100	.....	.....	.....	.....	.....	9
65	100	1	.....	6	.....	.....	.....
66	100	1	.....	3	.....	.....	.....
67	100	.....	1	10	.....	.....	.....
68	100	.....	1	6	.....	.....	.....
69	100	1	7	8	.....	.....	.....
70	100	4	1	6	.....	.....	.....
71	100	4	7	.....	.....	.....	.....
72	100	.....	8	5	.....	.....	.....
73	100	.....	.....	.....	.....	1	8
74	100	2	6	6	.....	.....	.....
75	100	.....	.....	.....	.....	2	2
76	100	5	2	.....	.....	.....	.....
77	100	.....	.....	.....	1	7	2
78	100	.....	.....	.....	.....	5	.....
79	100	2	7	1	.....	.....	.....
80	100	.....	.....	.....	1	.....	2
81	100	1	1	.....	.....	.....	.....
82	100	.....	.....	.....	.....	2	9
83	100	.....	10	6	.....	.....	.....
84	100	1	8	.....	.....	.....	.....
85	112	3	3	.....	.....	.....	.....
86	100	.....	.....	.....	.....	11	.....
87	100	.....	.....	.....	2	3	.....
88	100	.....	.....	.....	.....	4	.....
89	100	.....	11	3	.....	.....	.....
90	100	.....	8	2	.....	.....	.....
91	100	1	2	10	.....	.....	.....
92	100	1	7	.....	.....	.....	.....
93	100	.....	6	6	.....	.....	.....
94	100	.....	2	7	.....	.....	.....
95	100	.....	10	10	.....	.....	.....
96	100	.....	.....	5	.....	.....	.....
97	100	1	4	3	.....	.....	.....
98	100	1	4	11	.....	.....	.....
99	100	1	9	1	.....	.....	.....
100	100	3	10	7	.....	.....	.....
101	100	2	9	4	.....	.....	.....
102	100	.....	.....	.....	1	.....	2
103	100	2	.....	8	.....	.....	.....
104	100	1	5	1	.....	.....	.....
105	100	.....	.....	.....	1	2	6

TABLE—Continued.

Number of levels.	Distance, in yards, at which each level was taken.	Descents of land below the lake. Feet.	Inches.	Lines.	Heights of land above the lake. Feet.	Inches.	Lines.
106	100		8	6			
107	100					3	10
108	100		11	1			
109	100	2	5	4			
110	100					11	8
111	100	2		5			
112	100		11	4			
113	100					7	4
114	100				3	5	4
115	100				2		7
116	100					3	
117	100		11	4			
118	100		8				
119	100		9	3			
120	100	1					
121	100	2	5	2			
122	100					11	3
123	100	2	2				
124	100		11	8			
125	100				3	3	
126	100					5	6
127	100		2	6			
128	100		7	2			
129	100	3	2	7			
130	100		9	11			
131	100			10			
132	100	2	2	7			
133	100		4				
134	100					2	9
135	120	1	4	5			
136	100		3	2			
137	100	1	8	1			
138	100	1	11	6			
139	100	3	6				
140	100				1	2	9
141	100	2	9	8			
142	100	1	1	10			
143	100	5	4				
144	100					11	
145	100	2	9	8			
146	75	2					
147	100				6	3	
148	100					2	8
149	100				2	10	7
150	100	3	4	2			
151	100	2	3				
152	100			4			
153	100	1		8			
154	100		5	5			
155	100	1	5	8			
156	100		11	5			
157	100	1	9	5			
158	100	1	10	9			
159	100				1	9	4
160	100	4	3	4			
161	100					1	

TABLE—Continued.

Number of levels.	Distance, in yards, at which each level was taken.	Descents of land below the lake.			Heights of land above the lake.		
		Feet.	Inches.	Lines.	Feet.	Inches.	Lines.
162	100					6	8
163	100	8	1	2			
164	75	3		10			
165	100				3	6	
166	100				6	11	1
167	100	4	1	2			
168	100	1	2	9			
169	100	3	6	4			
170	100				4	5	6
171	100	3		3			
172	100	2	5	10			
173	100	7		8			
174	75	6	4	5			
175	50	9	7				
176	75	6		10			
177	75				2	2	8
178	75				8	3	1
179	75				8	5	
180	100				7	2	4
181	63	9	6	4			
182	50				3	10	2
183	50	8	4				
184	38	9		10			
185	73	5	9				
186	100	1	11	9			
187	100	2	1				
188	100						8
189	100	6	9				
190	70				5	9	4
191	100	10	5	6			
192	100	5	7	6			
193	100	2	6	5			
194	100	2	3	2			
195	100				7	3	5
196	100				1	5	1
197	22	11					
198	65	4	5	6			
199	42				7		
200	38				15	8	
201	70	7	10	6			
202	100		2	1			
203	100	5	1				
204	25	9	6	5			
205	41	10	6	8			
206	166	5	8	6			
207	79	7	9	10			
208	100	6	10	5			
209	80	9	10	4			
210	100	5					
211	84	7	1	10			
212	100	2	11	1			
213	100					2	6
214	100	6	9	2			
215	100	2	11	7			
216	120	5	1	5			

TABLE—Continued.

Number of levels.	Distance, in yards, at which each level was taken.	Descents of land below the lake. Feet.	Inches.	Lines.	Heights of land above the lake. Feet.	Inches.	Lines.
217	70	9	11	8			
218	64	3	5	1			
219	88						
220	100				19	1	
221	150	5	1	11			
222	40		8				
223	36	21	6				
224	32	7	1				
225	50	6	6	9			
226	54	5	11	8			
227	83	2					
228	100				2	6	4
229	100					10	
230	100	2	4	8			
231	132	5		3			
232	100				3		
233	100					1	10
234	100				8	7	7
235	100				5	7	10
236	100					11	8
237	100				1	2	
238	100					10	2
239	131				1	2	8
240	100				5		6
241	100	1	2	2			
243	100		11	4			
243	100	1	6				
244	100				1		
245	100	6	10	6			
246	100	4	4				
247	100				7	1	11
248	112				2	9	10
249	100				8	6	
250	100				8		4
251	100	4	8	10			
252	100				2	4	6
253	100				4	5	4
254	100				4	2	3
255	100				2	3	10
256	100				3	10	
257	100				3	3	11
258	100				2	5	
259	100				3	10	4
260	100					6	7
261	100				3	10	
262	100				1	3	2
263	100				2	11	3
264	100				1	1	9
265	100				1	8	
266	100				1	8	5
267	100				2	8	
268	100				2	10	2
269	100	4	5				
					2	9	10

TABLE—Continued.

Number of levels.	Distance, in yards, at which each level was taken.	Descents of land below the lake. Feet.	Inches.	Lines.	Heights of land above the lake. Feet.	Inches.	Lines.
270	100				1	7	1
271	100	1	7	1			
272	100				4	8	
273	100				2	9	2
274	100	5	2	3			
275	100				6	1	
276	100				2	7	7
277	100				3	1	9
278	120				9	4	7
279	62	5	6				
280	90	6	2	3			
281	100	2	3	2			
282	33	11	1	10			
283							
284	15	11	6	6			
285	13	11	7	7			
286	17	11	7	5			
287	33				9		1
288	21				12		
289	76				4	7	5
290	100	5	10	5			
291	100	8	4				
292	100	2	4	1			
293	100				3	4	9
294	100				2	5	4
295	100	1		5			
296	100	2	4				
297	100				4	3	6
298	100				3	10	
299	100				6	10	
300	100				4	1	9
301	100		4	3			
302	100	4	8	6			
303	100				2	4	2
304	100				5	11	
305	100	2	7	3			
306	100	1	4	6			
307	100	1		7			
308	80					10	6
309	100				2	11	6
310	100				1	7	3
311	100				1	10	5
312	100				1	2	5
313	100	2	3				
314	90	3	6	8			
315	80				10	2	8
316	100				5	4	7
317	100					8	3
318	100				2	11	6
319	100	1	5	4			
320	100	1	9				
321	100	1	7	5			
322	100				6	5	8
323	100				3	6	4

TABLE—Continued.

Number of levels.	Distance, in yards, at which each level was taken.	Descents of land below the lake. Feet.	Inches.	Lines.	Heights of land above the lake. Feet.	Inches.	Lines.
324	100	2	11	4	.....	.....	.....
325	82	.....	.....	.....	7	7	.....
326	68	.....	.....	.....	5	.....	4
327	100	.....	.....	.....	3	10	10
328	90	1	8	.....	.....	.....	.....
329	100	.....	.....	.....	5	2	5
330	100	.....	.....	.....	3	8	5
331	90	.....	.....	.....	.....	6	6
332	90	.....	.....	.....	2	4	3
333	100	.....	.....	.....	.....	10	2
334	95	.....	4	8	.....	.....	.....
335	100	3	7	10	.....	.....	.....
336	85	.....	.....	.....	7	9	2
337	100	.....	.....	.....	4	11	.....
338	100	.....	.....	.....	1	10	.....
339	95	.....	.....	.....	1	4	6
340	100	.....	.....	.....	3	.....	.....
341	100	1	2	4	.....	.....	.....
342	100	.....	10	5	.....	.....	.....
343	100	1	.....	7	.....	.....	.....
344	100	.....	.....	.....	1	7	8
345	100	.....	.....	.....	1	3	.....
346	34	.....	.....	.....	7	4	11
347	85	.....	.....	.....	11	.....	.....

The above is a copy of a plan in the archives of the republic.

1st JULY, 1825. G. A. THOMPSON.

N. B. By the foregoing table it appears that there were taken 347 levels at about 100 yards apart.

	Feet.	Inches.	Lines.
The aggregate amount of the descents of land between the South sea and the lake was.....	606	9	6
The aggregate amount of the heights of land between the South sea and the lake was.....	470	9	11
Making an excess of descents above the heights of.....	133	11	7

or forty-four yards one foot eleven inches and a half; which calculation is the level of the lake, at high water, above the average height of land between the lake and the South sea; but it should also be remarked, that, although in all the maps extant, THIS TRACT IS REPRESENTED AS MOUNTAINOUS, the greatest actual height of any part of the above land is only nineteen feet one inch, as appears by the level, number 219, in this table. The distance between the lake and the sea, at the proposed communication is, by the above measurement of 22,687 yards, only 4 four leagues 4,687 yards, of 7,000 yards Spanish to the league.

Note by the chairman of the committee on the error in the comment upon the table of levels in Thompson's Guatemala.

There is an error in the comment on the preceding table. The levels in the different columns of "descents below the lake," and "heights above the lake," are recorded in the same manner, and exhibit at each station the difference of level between it and the preceding station, and not the total rise and fall referred to any fixed point.

In the accompanying profile, constructed from these notes, the measures used are the Spanish, of 1899.26 yards to the English mile, which makes the distance from Lake Nicaragua to the Pacific ocean 17 miles 360 yards English, nearly.

At the end of the 9th mile 700 yards (English) from the South sea, the earth begins to rise above the surface of Lake Nicaragua, but does not exceed, for nearly one mile beyond that, an elevation, in any one place, 40 feet (Spanish) above that of the lake, and the average in this distance is less than 25.

After this the ground rises gradually, for three-fourths of a mile, from an elevation of 40 to 1 at the 218th station of 121 feet above the lake; at the 219th, 220th, and 221st stations it subsides to 108 feet; then it begins to reascend at the 221st, and at the 228th station, which is nearly 11¼ miles from the Pacific, it attains an elevation of 130 feet above the lake. From this to station 230 it continues gradually to rise till it reaches its greatest elevation, which is 155 feet for a short distance, and, for nearly 650 yards, averages 152 feet. At station 282 it begins to ascend, and speedily subsides to 135 feet, which it averages for about one mile beyond 14th mile from the Pacific. At the 245th station it rises to 142 feet, but, in less than 100 yards, descends to 135; and at the 249th station descends to 115 feet above the lake. After rising to 120 feet and descending to the 251st station, it begins regularly to descend till it reaches the 273th station, where, near the 14th mile from the Pacific, the elevation of the earth above the lake is 50 feet. Thence it again rises, in less than 200 yards, to 70 feet; and suddenly springs up, in less than 100 yards, to 115 feet. It as suddenly descends again to 93 feet at station 290, and thence, for nearly a mile, averages about 75 feet above the level of the lake. After that, to the shore of the lake, it descends gradually, falling in the commencement of the last mile and a quarter below 60 feet, and averaging for one mile about 35 feet above the level of the lake's surface.

All the difficulties, therefore, attending the construction of a continuous canal from the lake to the Pacific, occur in the eight miles next to the lake; for about six miles of which the elevation of the earth exceeds the surface of the lake far more than 60 feet; and for two miles of the six, it averages about 135 feet; and for about one-third of a mile, it reaches 160 feet, but never exceeds that height.

If the level of the lake be made the surface of the water in the canal, there must be added, for the cutting of a suitable ship

canal, 26 feet to the elevation; that being the quantity of water required for a ship canal suited to the draught of an armed Indiaman, which, when an enemy is to be apprehended, carries sometimes as many guns as a large frigate.

For the first 9 miles from the Pacific, the canal, except for 100 yards, where it is even with the natural surface of the earth, would be below it; and the gradual slope to the Pacific affords as favorable ground for a canal, of any dimensions, as could be anywhere found.

From Mr. Bolton to Mr. Mercer.

NEW YORK, *June* 18, 1838.

DEAR SIR: I have had the honor of receiving your letter of the 15th instant. The time you limit precludes the posibility of search for the manuscript copy of my report to the Secretary of the Navy. I will proceed, however, to state from memory the result of my remarks as to the feasibility of establishing a ship canal between the Atlantic and Pacific oceans, through the isthmus of Nicaragua. I visited that point in 1825, under the auspices of some mercantile friends in this city, with discretionary power of procuring a contract from the government of Central America; but, before I reached Guatemala, another citizen of New York had preceded me and taken the contract on the terms prescribed by that government.

The river St. John of the Atlantic, and the harbor of St. John of the Pacific, are the two prominent points, affording natural inlets from the sea, and, by information on the spot, for large vessels. The entrance from the Atlantic is bold; and the harbor is safe, but it is too small to accommodate a large number of ships. The same remarks may be made of the harbor of St. John of the Pacific, except that the latter is still more cramped; they would soon be found too small for the commerce which might be expected to be attracted to those points; but their localities appeared to me to be favorable to artificial extension.

The river St. John, emptying into the Atlantic, is the only outlet of the lake Nicaragua; it is generally a pretty rapid stream; has many sand banks, and one or more ledges of rocks, so that a boat drawing 18 inches is obliged to be discharged in the time of low water, where, in time of high water from 4 to 6 feet may be carried. The distance from the sea to the lake may be about 60 miles. Some high hills approach the river, but the country is generally level, and favorable to the construction of a canal from the lake to the harbor. The lake is said to be navigable for large ships; but it would be practicable, perhaps, to continue the canal along the lake shore to the village of Nicaragua, on the isthmus of that name, and which is distant from the harbor of St. John of the Pacific about 12 miles. I traversed these 12 miles on horseback; it is, for the most part, but little elevated above the lake; but as you approach

the Pacific, within about four miles, it becomes hilly, but the hills are not apparently so high as to require a tunnel for ships. There is no mountain near that point. The nature of the ground is extremely favorable on both sides of the lake; it is alluvial on the Atlantic side; the Pacific side is founded upon a species of rock very easy to work; probably it may be worked by a pick-axe, offering perfect solidity to the banks of a canal through the isthmus.

The lake, undoubtedly, will afford abundance of water as a feeder to the canal in its whole route from one ocean to the other.

The distance from one ocean to the other is about 140 miles, viz:

From the Atlantic to the lake, estimated at	60
From the junction of the St. John with the lake to the village of Nicaragua, on the opposite side, estimated at	70
Thence to the Pacific, estimated at	12
	142

The distances mentioned, the depths of water, and elevations of ground, must be ascertained by actual surveys; all I know certainly is, that the river St. John is too shallow for useful navigation; correct information as to the depths of the lake, the entrances of the harbors, and the harbors themselves, could not be obtained on the spot.

The harbor of Realejo is a much better harbor than that of St. John of the Pacific; and a practised engineer should, with that harbor in view, run a bird's-eye view from and through lake Leon in that direction, before deciding in favor of the route first mentioned; although I think this will be found to be the shorter and better route.

Upon the whole, I consider it quite practicable to construct a ship canal at this point from ocean to ocean, within a reasonable limit of expenditure; and were it the only one, it would probably have been done long ago.

I do not know that the elevation of lake Nicaragua above the oceans has ever been ascertained by actual measurement; as a loose conjecture, I should judge it to be 80 feet.

I shall be happy to answer any inquiries within my power which you may make of me on this subject; and am, very respectfully, your obedient servant,

C. BOLTON.

Hon. C. F. Mercer, *M. C.*

New York, *October 5*, 1838.

Dear Sir: When I had the pleasure of conversing with you last on the subject of the oceanic canal, referred to the committee of which you are chairman, you observed it would be agreeable to

you to receive any further information I might be able to give in relation to it; for which reason I take leave to communicate the following; though of little consequence, but perhaps worth advertising to in the report you may have to make on the subject at large.

There being reference in books and periodicals to a route for a canal by way of the river *Atrato*, emptying into the Atlantic, and the river San Juan emptying into the Pacific, whose sources are near each other, and having been inquired of by you respecting that route, I now transmit you herewith a translation of a Spanish document handed me by an intelligent gentleman of Lima, in 1839, describing that route probably more correct than any I have seen. Upon examining this, and a map accompanying it, you will, however, soon be satisfied that that route will not answer for a *ship canal*; and is much inferior to other routes for any sort of communication, by reason of the great distance between the two oceans, the want of depth in both rivers, and want of good harbors at both ends.

On reviewing the various accounts and authorities I have respecting the route by way of Lake Nicaragua, I find that some recommend a junction between that lake and the Pacific, not by a cut or passage across the ridge of land of which the elevations were taken, stated in the book called "Thompson's Guatemala," but by a much longer and probably better route—from the northwest end of the lake to the port of *Realejo*, not far from a city called *Leon*; to be supplied with water, on the summit level, from the lake called *Leon*, lying northerly from, and more elevated than, Lake Nicaragua, and emptying therein. This route would much increase the distance from sea to sea, already too long by the other, and is, therefore, too objectionable, but not impracticable. There is still another route from Lake Nicaragua to the Pacific, and apparently better, because much shorter, recommended by some writers, which was in the contemplation of the Holland Company when treating with Guatemala for the privilege of making a canal through its territory, viz: from the southwestern side of Lake Nicaragua to the bay and port of *Nicoya* on the Pacific, about twenty-five or thirty miles. Of this route less is known by actual explorations than of the other two.

In reference to the route by the river Chagres, which I have no doubt is *practicable*, and *preferable to any other*, I would observe that, on a review of all the authorities respecting it and further examination of the great question as to a supply of water at the summit level, I feel more confident than ever of a sufficiency of water being obtainable there for a *ship canal*. There are several streams rising in the high land of the isthmus, on each side of the contemplated route, besides the rivers Chagres and Trinidad, (either, perhaps, sufficient,) which may all be conducted into one spacious basin or reservoir, located high enough to feed a canal on the summit level both ways, though perhaps at heavy expense, which is of little consequence in regard to such a work as this. It is also possible to make an excavation, through the dividing ridge

of land between the two oceans, deep enough to admit the water from the bed of one or both those rivers to feed the canal on its summit level, and even deep enough to let the water of the Pacific supply that level every flood tide; as it rises daily from 14 to 16 feet, and is then so much higher (less 1½ foot) than the Atlantic. Such an excavation would probably not exceed the one in the valley of Mexico, described by Humboldt. But there is still another method of supplying that level if others fail—that of raising the water out of a reservoir filled by streams into a higher one on the summit level, by means of forcing pumps, like the Philadelphia water works supplying the city, and those on the Pennsylvania Union canal for supplying the summit level thereof. The former elevates water out of the Schuylkill, by six forcing pumps united, to the height of one hundred and ten feet, at the rate of 3,000 gallons per minute, into a reservoir constructed at that height, covering six acres of ground, and holding twenty odd millions of gallons.

There is a consideration of great weight and importance, in my opinion, bearing on the subject of the ship canal in contemplation, which I have stated to different persons, and I believe to yourself, but has not apparently struck other minds as forcibly as my own, and which I beg leave to repeat to you, with some reference to the facts in its support. Suppose the United States should omit taking any measures in relation to a communication between the Atlantic and Pacific oceans, is it not highly probable that some other government will ere long undertake and execute the work separately, and then reserve to itself its use and benefits, excluding all others from any participation, or allowing it only occasionally, or on the most unreasonable terms; thus annoying the commerce of the world, and particularly that of the United States? And suppose that government to be Great Britain, (as probably it would,) the mistress of the ocean, and the monopolist of every commercial advantage in its power over the world: what then would be the consequence but a perpetual subjection to the will or caprice of that government for one of the greatest boons or privations on earth? what then the state of the public mind, but regret and mortification for having neglected to guard against an evil of such magnitude? Or suppose (what is still more probable) that the government and citizens of either of the countries through which a canal is practicable should undertake its construction on their own account, by means of foreign capital obtained on the security of the canal itself, or its income, (which no doubt they would prefer whenever in their power, and that may be soon;) then all the world would be subject to their dictation for the use of it, however unreasonable, until wrested from them by force by some stronger power, and that perhaps would lead to war with other powers; and then all would regret the want of foresight and precaution in not having guarded against such consequences.

From the mere possibility of such results occurring through our own omission to act with prudence and foresight, it behooves us to attend to the matter without more delay. Many minds have

been reflecting on this subject; many eyes are turning to the isthmus, and plans may be forming and ripening for the execution of the project, without our knowledge, and with design to exclude us from co-operating and equally enjoying the benefits. This leads me to advert to some of the facts referred to in support of my views. One is, that, in consequence of a heavy debt owing by the government of New Grenada to some of the subjects of Great Britain, for which no provision is made, either to pay interest or principal, the creditors have suggested and recommended to their government to negotiate with that of New Grenada for the purchase of the territory comprehending the isthmus, and assume their debt as an offset for its value, or in part; and stated their belief it *could* be effected with immense advantage to the nation as well as themselves. This indicates some danger, at least, that Britain may become possessed of the isthmus ere long.

Another fact is, that the inhabitants of the isthmus have long been desirous of dissolving their connexion with New Grenada, and becoming a separate State, under the protection of some powerful government willing to guaranty their independence, and able to assist them in opening a navigable communication through their territory *for their joint benefit*. This indicates a similar danger, either that Great Britain or some other great strong power will become masters of the isthmus, in conjunction with the local authorities thereof.

And another fact worth adverting to is, that the government and citizens of Holland have once manifested their views in regard to a canal across the isthmus, and may again step forward separately to undertake the construction of one on their own account, which would not comport with our interests.

Independently of these facts, it is certainly to be presumed and inferred, from the spirit and the progress of improvement the world over, that such an important object as the one in contemplation will be accomplished, or undertaken at least, within a few years; and it is now time for us to consider what share or interest we ought to take therein. Why not take the lead at once, as invited by situation and circumstances, and try to form the necessary combinations? A mere survey of the isthmus, and certain overtures to other governments, are the only preliminary steps required.

Very respectfully, yours,

WM. RADCLIFF.

The Hon. C. F. Mercer.

[Translation of the Spanish document referred to in the preceding letter.]

The incalculable advantages which Colombia and the whole world will receive through the communication by water from the Atlantic to the Pacific, without being exposed to the imminent risks of the Cape Horn, are so generally acknowledged, that I shall not expatiate in describing them. The celebrated Humboldt was

the first man who proved that an easier communication could be established between the two oceans by the *Choco*, than by the isthmus of Panama—an opinion which before had been universally repelled, owing to the then existing ignorance of topographical knowledge of it.

Great objects cannot be effected without great sacrifices; and, as experience has taught us that the establishment of companies has always proved the surest way to succeed in an undertaking, whenever the governments, owing to their greater attentions, cannot support heavy expenses, I therefore propose the following plan, which, if adopted, would facilitate the said communication by the rivers *Atrato* and *San Juan*:

Geographical description of the rivers Atrato, on the coast of the Atlantic, and San Juan, on that of the Pacific.

The utility which would arise in the establishment of steamboats on the great river Atrato, is so manifest that it is useless to enter into long arguments thereon, for persons possessing common sense will easily perceive it. But, as there may be some who would gladly invest their funds in the prosecution of a reasonable and prudent undertaking, and who may only be kept back by their want of information on the geographical situation of the *Choco*, I herein give the following description with the sole view of proving to them the facility of the project in view, and of showing the immense advantages that would arise thereby.

The principal mouth of the Atrato, called *Barbacoa*, is situated 8° 12′ north latitude, and extends itself for a distance of 530 miles to its head. At the entrance of this river, on the Atlantic, is the great bay of *Candelaria*, capable of holding all the ships in the universe; it has good anchorage from the depth of 18 to 20 fathoms; is sheltered from all winds, and only subject to heavy swells whenever the northerly winds prevail.

In summer, the bank has 5 feet at low-water mark; and in winter, the high-water mark is as much as 6 feet. Its breadth is nearly 200 yards in dry weather; and its bottom hard sand.

The principal river, of some magnitude, which empties itself into the Atrato, is the one called Sucio, of 70 miles in length, and in 7° 46′ north latitude. This river, in its present state, does not offer any advantage, owing to many sticks and other impediments which it has.

The second is called Muriendo, in 7° 46′ north, and is 150 miles distant from the mouths of the Atrato. Twenty miles from its union with this river, are very high mountains, which bear the same name, and abound in very hard timber, and cedar of various kinds.

The third is the river Napipi, emptying itself at 6° 33′ north latitude. By means of this river, a communication can be opened with the Pacific ocean, for there are only six miles from its head to the coast. The cost now for carrying a bale of 5 arrobas is one

dillar; and arrives at a bay which is both deep and sheltered from the winds that prevail in the Pacific.

From the entrance of the Napipi to the Atrato, as far as the Tambo, called the Antado, or Don Carlos, while ascending, there is three and a half days' voyage. From this one to the Cubica, on the Pacific ocean, the traffic is by land, and two journeys may be made in one day. The loads are carried on men's shoulders; but mules may be used, by mending the road. The port of Cubica is suitable for all classes of vessels.

The fourth river which empties in the Atrato, is Bevara; it is situated in 6° 2' north latitude. Fifteen miles from its mouth, up the river, is a warehouse, where goods are deposited, going to Antioquia. From this warehouse to Orras, there are 60 miles of land way. The loads are taken here also on men's shoulders, and are on the road about seven days. The cost on this road for a package of 5 arrobas is twelve dollars. From Urras to Antioquia, there are 40 miles, more or less. The loads here are conveyed on mules, and the cost is four dollars per load.

The capital of the province of Citará, is the city called *San Francisco de Quibdó*. It contains a population of 2,000 souls; here is a parish church, and also a custom-house.

As far as this place, the river Atrato does not present any obstacle for the navigation of vessels of any classes, which may not draw above 7 feet water. In the route very few sticks are met with, and with care there is no danger.

Quibdó is 410 miles from the mouths of the Atrato; which river, in summer or dry season, has a current of not over 2 miles per hour; but in winter, or wet season, is often as much as 5. From the capital to the source of the river, there may be 80 miles.

The Tambo of San Pablo is situated on a narrow neck of land, which may be 1½ league wide.

The river of *San Juan*, corresponding to the province of Novita, waters the other side of this isthmus; and, meeting with the river Calina, empties itself in the Pacific; and here is the port and bay of *Charambirá*.

Opposite Quibdó, the rivers Quito and Atrato unite; by that you ascend unto the bank of San Pablo, which, in summer time, presents some difficulties in its traffic on account of the scarcity of water; but, it only being 5 hours' voyage to the Tambo of the same name, this inconvenience could easily be remedied by means of locks such as are used in Europe.

The above description is very plain; yet, at the same time, it gives a faithful account of the country. The utilities that would result from this project are indisputable; consequently, I shall not detain myself in describing them. I shall only add, that to private individuals and owners of lands, it would be very advantageous; for commerce will be extensively opened from the very first day a steamboat floats on this river, owing to the moderate freights; consequently, the value of landed property will increase, and the rent of houses be double. All articles of comfort and necessary for life will abound, and be obtained at moderate prices; and, in short,

Quibdó will be the depot of riches; an effect which must be produced by such a traffic, and which will admit of no rivalship. The State will derive no less advantages; for it will cause an extension of import duties, and armed boats will be able to protect the persons interested from the danger arising from invasions of the enemy on the river, by the provinces of Choco. To this may be added, that the grounds which now are uncultivated, on account of their being overflown the best part of the year from the currents of the Atrato and other rivers, could be put in a state of cultivation by such improvements as the industry of foreigners, who would fly to the protection of a liberal and free government, would make; and thus the Atrato would become a second Mississippi.

Here I end my description, having said sufficient to show the facility that exists to put into practice a communication between the Atlantic and the Pacific.

COMMITTEE-ROOM OF COMMITTEE ON ROADS AND CANALS,
March 2, 1838.

SIR: In obedience to the instructions of the Committee on Roads and Canals, I have the honor to transmit to you the accompanying resolution, and to request, in their behalf, your early attention to its object. The work on Guatemala, referred to in the resolution, accompanies it; and, being a book from the Congressional library, taken out in my name, I will thank you to cause it to be returned when it shall have answered the purpose for which it is transmitted.

Should the library of your department afford any other work calculated to aid the committee in the investigation with which they are charged, (or the practicability of uniting the Atlantic and Pacific by a continuous ship channel across the isthmus which separates North and South America,) the use of it will confer a favor on your very respectful and obedient servant,

C. F. MERCER,
Chairman of Committee on Roads and Canals.

Colonel J. J. ABERT,
Chief of the Topographical Bureau, War Dept.

Resolved, That the chairman of the committee be instructed to request the chief of the topographical bureau to cause a cross section of the country between Lake Nicaragua and the Pacific ocean, surveyed by order of the captain general of the kingdom (now the republic) of Guatemala, to be prepared, on a scale of moderate dimensions, from the table of levels supplied by the appendix to Thompson's Guatemala, and to lay the same before the Committee on Roads and Canals.

The following letter and estimate were supplied by the topographical bureau of the War Department, in answer to a request of the chairman in behalf of the Committee on Roads and Canals. The estimate supposes the dimensions of the canal to exceed those contemplated in the report of the committee by a depth of four feet; but, being calculated for vessels of the greatest draught of water, are to be preferred, if they shall not be found to augment the cost of the canal to an extent beyond the means which can be provided for its construction:

WASHINGTON, *April* 5, 1839.

SIR: I herewith enclose a rough estimate of the cutting from Lake Nicaragua to the Pacific. It is, of course, very imperfect, and can barely serve to give an idea of the magnitude of the work. The prices I cannot even approximate, having no knowledge of the soil.

Very respectfully, your obedient servant,

THOMAS J. LEE,
Lieutenant Topographical Engineers.

Hon. C. F. MERCER.

Quantity of material to be removed by excavation in the construction of a ship canal of 130 *feet water surface,* 30 *feet deep, and* 40 *feet wide at bottom, from the South sea to Lake Nicaragua, as nearly as it could be ascertained from the data in "Thompson's Guatemala," with the approximate position of the locks.*

No. of miles from the South sea.	Quantity of material to be removed.	Lockage.	Remarks.
	Cubic yards.		
1st mile.....	337,770	2 locks of 10 feet lift	In the first nine miles the surface of the water in the canal is placed above the natural surface of the ground, and the quantity excavated is more than sufficient to form the banks of the canal. The locks to be 250 feet long by 65 feet broad. In this estimate, the upper surface of the ground is assumed horizontal, as no *inclinations* are given.
2d mile.....	284,205		
3d mile.....	297,540	2 locks of 10 feet lift	
4th mile.....	253,110	1 lock of 10 feet lift	
5th mile.....	318,221	2 locks of 10 feet lift	
6th mile.....	354,730	1 lock of 10 feet lift	
7th mile.....	216,220	2 locks of 10 feet lift	
8th mile.....	191,774	1 lock of 10 feet lift	
9th mile.....	201,845	2 locks of 10 feet lift 1 lock of 11 feet lift	
10th mile*.....	862,290		
11th mile.....	4,618,997		
12th mile.....	11,026,659		
13th mile.....	8,392,058		
14th mile.....	4,824,630		
15th mile.....	6,038,177		
16th mile.....	4,252,598		
17th mile.....	1,914,984		
9 yards.....	183,812		
17 miles 310 yards.	44,680,462	141 feet lockage.	

* Commencement of deep cut.

That such a labor may not appal the imagination, as an open cut from sea to sea would, let the following correct description of a Mexican enterprise suffice:

Extract from "Humboldt's New Spain," (vol. 2, page 93,) describing the canal or drain constructed to relieve the valley of Mexico from surplus waters, called the "Desague of Huehuetoca," probably the largest excavation in the world.

In its present state, the canal of derivation of (Desague) of Huehuetoca contains, according to the measurements of M. Velasques, from Verideros to the Salto, 24,530 Mexican varas, or 20,585 metres; equal to 67,535 feet, or 12 miles, 63 chains, and 19 feet. In this length of four and three fifths common leagues, the chain of the hills of Nochistongo, (to the east of the Cerro de Cincoque,) constituting a fourth part of it, has been cut to an extraordinary depth. At the point where the ridge is highest, near the old well of Don Juan Garcia, for more than a length of 800 metres, (2,624 feet or half a mile,) the cut in the mountains is from 45 to 60 metres, (147 to 196 feet,) in perpendicular depth. From the one side to the other, the breadth at top is from 85 to 110 metres, (278 to 360 feet.)

[*Note.*—To have a clearer idea of the enormous breadth of this trench in the Obra del Consulado, we have only to recollect that the breadth of the river Seine, at Paris, is, at Fort Bonaparte, 102 metres, (334 English feet;) at Pont Royal, 136 metres, (446 feet;) and at the Pont d'Austerlitz, near the botanical garden, 175 metres, (574 feet.)]

The depth of the cut is from 30 to 50 metres (98 to 131 feet) for a length of more than 3,500 metres, (11,482 feet, or 2 miles and 14 chains.) The water course is generally only from 3 to 4 metres, (9.84 to 13.1 feet) in breadth; but in a great part of the Desague, the breadth of the cut is by no means in proportion to its depth; so that the sides, in place of having a slope of 40° to 50°, are much too rapid, and are perpetually falling in.

Page 98.—It appears, from a manuscript memoir of Don Ignacio Castiva, present inspector of the hydraulical operations in the valley of Mexico, that the Desague, including the repairs of the dike (albarodones) between 1607 and 1789, cost the sum of five millions five hundred and forty-seven thousand six hundred and seventy double piasters, (5,547,670.) If we add to this enormous sum from six to seven hundred thousand piasters expended in the fifteen following years, we shall find that the whole of these operations (the cut through the mountains of Nochistongo, the dike and the two canals from the upper lakes) have not cost less than thirty-one millions of livres, (or £1,291,770 sterling.)

The estimate of the expense of the canal du Midi, (Languedoc canal,) of which the length is 238,648 metres, (or 782,966 feet or 148 miles and 508 feet,) notwithstanding the construction of 91 locks and the magnificent reservoir of St. Ferrol, was only 4,897,000 francs, (£204,057 sterling;) but it has cost, from 1686 to 1791, the sum of 22,990,000 francs (£958,368 sterling) to keep this canal in order. (See Andreossy's Histoire du Canal du Midi, page 389.)

IN SENATE OF THE UNITED STATES.—January 31, 1849.

Mr. DAVIS, of Mississippi, made the following report:

The Committee on Military Affairs, to whom was referred the memorial of the General Assembly of the State of Arkansas, recommending the survey of a route and the construction of a national road to the territory recently acquired from Mexico, and suggesting as the most eligible line of location that which shall commence at Fort Smith, on the western border of said State, and pass through the valley of the Canadian river to Santa Fe, and thence to California, have considered the same and report:

That the committee recognize in the proposition of the memorialists a work fully warranted by its necessity as connected with the military defence of the frontier, and the efficient regulation of intercourse with the Indian tribes. Successfully to execute these proper duties of the government, military roads and posts and Indian agencies are requisite; and scarcely less so that intimate knowledge of the topography of the country essential in the conduct of all military operations. In no case could such knowledge be more indispensable than that which is presented by the duty to control the nomadic tribes who roam over the plains of the "great prairie," and through the mountain fastnesses which lie beyond it. Familiar with the defiles, these Indian tribes could elude the pursuit of the best troops, who should, without proper reconnoissance having been previously made, attempt to check or chastise depredators on remote settlements or emigrating parties.

To maintain civil government in our transmontane possessions, to promote their early occupation by emigrants from these States, and to perpetuate the political union of the Atlantic and Pacific slopes by continuous lines of settlement from ocean to ocean, it is deemed necessary to open the shortest and best routes from the valley of the Mississippi to the Pacific, and to give the greatest possible security to the transit of persons and property. It is believed that a speedy commercial route is not more required by the financial, than by the political interests of our country. In this view the committee cannot be indifferent to speculations which involve such great results, but recommend nothing except as connected with the military defence.

The route suggested by the memorialist, like that from Independence, Mo., has been explored. Both are considered practicable; both, though not in an equal degree, are obstructed by winter snows and pass over a desert prairie. The Red river on the east, and the Gila on the west, of the vallay of the Rio Grande, rising in the mountain ridges nearly opposite to each other, and running thence to the Mississippi and the Gulf of California, suggest the idea of a route being found through the valleys of these

rivers to connect the opposite sides of the continent together, and which would pass through a country capable of supporting the requisite population to maintain a thoroughfare of such importance. Much of the Rio Grande below the town of El Passo is unexplored; its examination could be made in executing the boundary survey, and this, with the survey of the mountain range on the east side of the Rio Grande, and south of Santa Fe, would furnish data upon which to locate roads, posts and agencies, for the protection of that frontier, and the regulation of intercourse with the Indian tribes who inhabit it.

These explorations will have to be made to a great extent in a desert region, among savages with whom the government has not established friendly intercourse, and therefore must be protected by strong escorts, and furnished with transportation for the conveyance of a large part of their subsistence. The escorts may, it is believed, be principally furnished by the army, and it is hoped that expeditions properly conducted, and penetrating regions heretofore unknown to civilized man, will be, in an eminent degree, productive of an amicable disposition on the part of the aborigines thus visited towards the citizens of the United States. If this hope should be fulfilled, the troops so employed will have been engaged in their highest function, the preservation of peace.

The estimate of the chief of the topographical engineers, in his report of this year, is taken as a guide, and the appropriation asked for in the resolution of the committee corresponds generally with the statement of that officer, viz:

For military surveys in	Nebraska	$10,000
" " "	California	10,000
" " "	New Mexico	10,000
" " "	Texas	15,000
Contingent expenses		5,000
		$50,000

In the first item Nebraska is substituted for Oregon. No estimate is made for the exploration of the lower Rio Grande, because it is considered as appropriately belonging to the survey and establishment of the boundary between the United States and the republic of Mexico.

It being no part of their duty, so it is not the purpose of the committee to recommend measures of civil policy, but only to refer to political considerations as recommending the military measures proposed. The establishment of posts must be preceded by the construction of military roads, and these roads and posts, giving facility, inducement and protection to emigrants, will be followed by settlements, which will remove the necessity for the maintenance of garrisons; unite the regions on opposite sides of the mountain ridge which divides the continent, by successive links of farms and villages, lead to the construction of commercial roads,

and bind the whole country by constant intercourse and common interest durably together. The dangers, the difficulties, the privations and delays, which have attended transit by the overland route, have produced an anomaly in the history of our settlements. Emigration, instead of steadily advancing, has passed around our territory through a foreign country, to locate on the shores of the Pacific, leaving an unpeopled desert between their new homes and the country they have left. If anything could, this might alienate American citizens from the government of the United States. These considerations, it is hoped, will illustrate and enforce the propriety of the measures recommended; as the first step in the execution of which the committee report the accompanying resolution.

Report of the Secretary of State, in compliance with a resolution of the Senate, of February 24, 1846, calling for information relative to a ship canal across the isthmus of Panama.

DEPARTMENT OF STATE,
Washington, May 7, 1846.

In compliance with the resolution of the Senate, of the 24th of February last, directing the Secretary of State to communicate to that body "any despatch or information he may have received from either of the ministers of the United States abroad, on the subject of a ship canal across the isthmus of Panama, and of opening new channels of communication with the eastern nations," the undersigned has the honor to transmit the papers mentioned in the subjoined list, which contain all the unpublished information on the files of this department, embraced by the resolution. It is to be observed that Mr. Wheaton's despatches are accompanied by a printed memoir of Messrs. Solomon & Co., in the French language, containing several maps, and, also, by an engraved sheet containing a number of maps, on a minute scale, replete with details, and lettered in the German language; the copying of which papers would be a very nice and expensive piece of work. In the uncertainty as to the views which the Senate might entertain upon this point, after being informed of the nature of those appendages, it has been deemed advisable, for the present, not to have copies of them made.

JAMES BUCHANAN.

To the SENATE OF THE UNITED STATES.

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List of accompanying papers.

Mr. Blackford to Mr. Upshur, October 20, 1843. (Extract.)
Mr. Acosta to Mr. Blackford, October 9, 1843. (Translation.)
The minister for foreign affairs, of New Grenada, to the Secretary of State of the United States, September 30, 1843.
Mr. Blackford to Mr. Acosta, October 14, 1843.
Mr. Blackford to Mr. Upshur, November 3, 1843. (Extract.)
Abstract of instructions given by the Grenadian government to Mr. Mosquera, their chargé d'affaires at London. (Translation.)
Mr. Blackford to Mr. Upshur, February 2, 1844. (Extract.)
Mr. Bidlack to Mr. Buchanan, December 23, 1845. (Extract.)
Mr. Nelson to Mr. Bidlack, September 1, 1845. (Extract.)
Mr. Wheaton to Mr. Buchanan, December 17, 1845.
The same to the same, December 24, 1845.

Mr. Blackford to Mr. Upshur.—Extract.

[No. 16.] LEGATION OF THE UNITED STATES,
Bogota, October 20, 1843.

* * * * * * * * * *

I have received a copy of a communication lately addressed to yourself direct, by this government, on the subject of a communication across the isthmus of Panama. I send you herewith a transcript of the same, together with copies of the notes which passed between the secretary of foreign relations and myself on the occasion.

Aware of the importance of this question, and of the lively interest felt in it by our government, I waited upon the secretary to ascertain, if possible, the present views of the cabinet at Bogota. He promptly informed me he had no objection to submit the instructions lately given to the chargé d'affaires of New Grenada at London, and all the correspondence on the subject. As I could not, of course, ask for copies, it was arranged that his chief clerk should be empowered to read to me the instructions and correspondence from the books of the office. I was in hopes I could by this mail give you such information as I could thus gather; but the chief clerk has been so much occupied as not yet to find time to devote to me. I hope, in a few days, to be able to apprise you of the views of this government.

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Mr. Acosta to Blackford.—Translation.

OFFICE OF FOREIGN RELATIONS,
Bogota, October 9, 1843.

Accompanying this note, the honorable William M. Blackford, chargé d'affaires of the United States, will find an authenticated copy of a communication which the government of the undersigned was pleased to direct, on the 30th of September last, to the Secretary of State of the cabinet at Washington, and of which his excellency the President has thought proper the honorable Mr. Blackford should be informed.

The undersigned avails himself of this opportunity to reiterate to the chargé d'affaires of the United States the assurances of his consideration and respect.

JOAQUIN ACOSTA.

Hon. WM. M. BLACKFORD, &c., &c., &c.

Translation of a note from the minister of foreign affairs of New Grenada.

REPUBLIC OF NEW GRENADA,
Department of Foreign Relations, Bogota, September 30, 1843.

The government of New Grenada, desiring to afford to the commerce of nations the advantages which would result from a communication between the Atlantic and Pacific, across the isthmus of Panama, has resolved to invite the governments of the principal maritime nations to conclude a treaty with the object of carrying this great undertaking into execution, as well that the governments should take upon themselves the execution of the work, as that they should guaranty the neutrality of the communication between the seas, and the fulfilment of the conditions stipulated for its execution. Full powers have been, in consequence, given to Señor Manuel Maria Mosquera, charge d'affaires of the republic near the government of her Britannic majesty, to treat with the plenipotentiaries who may be appointed to that effect.

As the government of the United States is one of those which the government of New Grenada desires to see participate in the treaty in question, I have received orders from my government to make you acquainted with the same, in order that, if the government of the United States should judge proper to join its efforts for the consummation of the important work of opening the communication between the two oceans, it may authorize some person to take part in the negotiation proposed.

I avail myself of this opportunity to represent to you, sir, the assurances of the high consideration and distinguished respect with which I have the honor to subscribe myself your most obedient and attentive servant,

MARIANO OSPINA.

To the SECRETARY OF STATE *of the United States.*

Mr. Blackford to Mr. Acosta.

LEGATION OF THE UNITED STATES,
Bogota, October 14, 1843.

The undersigned, charge d'affaires of the United States, has had the honor to receive the note which, under date of the 9th instant, the honorable Colonel Acosta, secretary of foreign relations, addressed to him, transmitting a copy of a communication on the subject of a connexion between the Atlantic and Pacific oceans, which the government of New Grenada has forwarded to the Secretary of State of the United States.

The subject of a communication across the isthmus is one in which the government of the undersigned has ever felt a lively interest; and he doubts not prompt attention will be given to the

ence of the honorable secretary of foreign relations, a copy of which the undersigned will also transmit to Washington.

The undersigned renews, &c.,

WM. M. BLACKFORD.

To Colonel JOAQUIN ACOSTA, &c., &c., &c.

Mr. Blackford to Mr. Upshur.—Extract.

[No. 17.] LEGATION OF THE UNITED STATES,
Bogota, November 3, 1843.

SIR: In my despatch of the 20th ultimo, I had the honor to state that the secretary of foreign relations promised to apprise me of the main points of the instructions given to Mr. Mosquera, the Grenadian charge d'affaires at London, touching the construction of a canal across the isthmus of Panama, in which enterprise the co-operation of the government of the United States was solicited. In fulfilment of this promise, his chief clerk waited upon me a few days since with an abstract of the instructions made by direction of the secretary, of which I have the honor to transmit a translation.

The grant made to Baron Thierry, or the Franco Grenadian Company, was, a few weeks since, surrendered to the government.

* * * * * * * * *

[Translation.]

Abstract of instructions given by the Grenadian government to Mr. Mosquera, their charge d'affaires at London, on the subject of the Panama canal.

Mr. Mosquera is authorized, 1st. To conclude a treaty with the governments of Great Britain, France, the United States, Holland, and Spain, or with one or more of them, in order that the said governments may charge themselves with the enterprise of opening a canal of large dimensions across the isthmus of Panama, reserving to New Grenada the jurisdiction over the line of communication which may be constructed, and a certain per centage of the reduction of the tolls, until the cost of the canal is reimbursed; after which, the whole of the tolls.

2d. To conclude a treaty on the same terms whenever a private company wishes to undertake the enterprise; in which case the stipulations of the treaty must be limited to those governments which will guaranty the neutrality of the canal and of the ports on either ocean at its *termini*, as well as the sovereignty of New Grenada over the canal and its territory, and the fulfilment of the

conditions upon which the privilege is granted to a private company.

He has also been instructed that no invitations for proposals shall be made until one or the other of the two kinds of treaty specified is effected.

The bases of the treaties once sanctioned, the rest of the instructions relate to details, as, for example, that each one of the contracting governments shall name an individual to form a commission, which, residing on the isthmus, shall take charge of the general conduct of the work.

The government of New Granada will give, as its contribution to the enterprise, the woods, quarries, and mines of mineral coal, as well as the public lands which may be required, to the extent of 300,000 acres; these lands not only to be applicable to the construction of the said canal, but may be distributed among immigrants who may wish to settle there, in quantities not exceeding 200 acres to one family. The commencement of the enterprise must be made within two years from the date of whatever treaty is concluded. The troops necessary to protect those points (which will be few in number, as the canal is to be neutral) must be Grenadian, but paid by the contractors. All persons employed on the canal whilst it is constructing, or when finished, will of course be subject to the laws of New Grenada, but can be exempted from military service and from forced loans.

The fundamental principle is the equality of all nations who may participate in the enterprise in either of the ways above indicated.

The rest of the clauses relate to the giving more security to the collection of tolls which may be imposed, and to the sovereignty of New Grenada in those territories.

Mr. Blackford to Mr. Upshur.—Extract.

[No. 20.] LEGATION OF THE UNITED STATES,
Bogota, February 2, 1844.

* * * * * * * * *

Two distinguished engineers, despatched by the French government, are now engaged in surveying the isthmus of Panama, with reference to the practicability of constructing a canal. I have not been able to ascertain the circumstances which have induced this movement. It must have been resolved upon anterior to the circular note of the Genadian government, a copy of which I had the honor to transmit with my No. 16.

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Mr. Bidlack to Mr. Buchanan.—Extract.

[No. 2.] LEGATION OF THE UNITED STATES,
Bogota, December 23, 1845.

* * * * * * * * * *

While at Carthagena, I wrote to Mr. Nelson an unofficial letter, requesting all the information in his possession in relation to the communication across the isthmus of Panama. As the answer was written before his recognition here as consul, and is not of an official character, I have enclosed the original herewith, as containing all the information on this point which I have been as yet able to obtain.

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Most truly and respectfully your obedient servant,

B. A. BIDLACK.

Hon. JAMES BUCHANAN, *Secretary of State.*

Mr. Nelson to Mr. Bidlack.—Extract.

PANAMA, *September* 1, 1845.

* * * * * * * * * *

It will give me great pleasure to comply with your excellency's request to lay before you any information which may come to my notice in relation to overland communication across the isthmus, and you may rely upon my making you acquainted with everything important that may come to my knowledge respecting it.

In February last, Captain Siot, marine superintendent of the Royal Mail Steam Company, arrived here in company with Mr. William McGeechy, road surveyor of Jamaica, professedly with the purpose of exploring the isthmus between Porto Bello and Panama, and Panama and Chagres, by command of the directors of the Royal Mail Steam Company, and reporting as to the feasibility of making a good macadamized road between the Atlantic and Pacific oceans. These gentlemen remained a month in the country, and Mr. McGeechy explored all the country between this and Chagres, but found the ground very swampy, and many difficulties from the badness of the port of Chagres. He then examined the ground between this and Porto Bello, and reported himself perfectly satisfied with the result of his labors, as the nature of the ground opposed no impediment whatever to the making of a good carriage road, which he recommends should be a paved road, as macadamized roads, from the wetness of the climate, would be continually in bad order. This gentleman estimated that the sum of one million of dollars would suffice for the construction of the road and the necessary wharves at either terminus.

* * * * * * * * * *

I have the honor to be, very respectfully, your excellency's most obedient servant,

WM. NELSON.

Hon. B. A. BIDLACK,
Chargé d'Affaires, &c., &c., &c.

Mr. Wheaton to Mr. Buchanan.

[With a map.]

[No. 278.] BERLIN, *December* 17, 1845.

SIR: The application of steam power to facilitate the social and commercial intercourse between the different quarters of the globe has recently acquired a vastly increased importance, as connected with other great changes which may certainly be anticipated as about to take place in respect to the channels of that intercourse. The object of this despatch is to present to the department some views which have occurred to me respecting this subject, as being of paramount importance to the commercial and political interests of the United States, and to the future prospects of human improvement in every quarter of the globe.

The principal revolutions which are believed to be impending in the communications between the continents of the old and the new world are the following:

1st. The re-opening of the ancient water communication between Europe and the East Indies by Egypt and the Red sea, which must inevitably result either from the permanent establishment of the new Mohammedan dynasty, founded on the banks of the Nile, or from the future colonization of Egypt by some European nation.

2d. The opening a new route from the United States and Europe to the East Indies by the construction of a ship canal between the Atlantic and Pacific oceans, across some part of the isthmus which connects the two continents of North and South America.

The improvement of both these communications by the above mentioned means would encircle the globe with a continued line of navigation, carried on by steam power, throughout the northern hemisphere, between the equator and the parallel of the 40th degree of north latitude; thus avoiding, in the passage both from west to east and from east to west, the immense *detour* caused by the projection of the two great promontories by which the continents of Africa and America are terminated in the southern hemisphere. The vast importance of both these routes to the world in general is self-evident; and the peculiar importance of the second to the United States in particular will not be in any degree diminished by the increased facilities which the reconstruction of the ancient water communications between the Red sea and the Mediterranean would give to the commercial intercourse between Europe and Asia.

It is well known that from the earliest periods of human history, down to the discovery of the passage by sea round the Cape of Good Hope, the commerce of India was regarded by the nations bordering on the Mediterranean as a perennial source of wealth, and the surest basis of maritime power. This commerce was carried on through the Arabian gulf, from very early times, by the Phœnicians and by the Jews during the flourishing reigns of David and Solomon, as well as overland through Palmyra by means of caravans of camels, called, in the expressive language of oriental

metaphor, "ships of the desert." The religious prejudices of the ancient Egyptians against navigation by sea did not prevent some of their earliest Pharoahs from projecting a ship canal to connect the Nile with the Red sea. This project was resumed by the Persian sovereigns of that country, and ultimately realized by the Ptolemies and the Arabian caliphs. The remains of this stupendous work were discovered and its course distinctly traced by the French engineers who accompanied the Egyptian expedition. Three hundred years had elapsed from the time that Vasco de Gama had doubled the stormy cape to the landing of Bonaparte in Egypt. The communication between the Mediterranean and the Red sea, which lost its importance in the eyes of the commercial world in 1498, was once more resumed in 1798, as connected with the motives which had prompted that expedition. The immense commercial and political advantages of the conquest and colonization of that country had already been anticipated by Leibnitz, in his memoir communicated to Louis XIV. The young hero who commanded "the army of the east," and who already emulated the fame of Alexander on the same scene of action, explored in person the vestiges of the ancient canal which had once connected the waters of the Nile and the Red sea; and, by his directions, Monsieur le Père, a distinguished engineer connected with the expedition, continued this examination during the years 1800 and 1801. The results of these observations were subsequently given to the world in an admirable memoir, written by that distinguished officer, who had now become inspector general of the *Ponts et Chaussées*, presented to the First Consul in 1803, and printed in the first volume of the magnificent work on Egypt, published by the imperial government of France. It may be fairly inferred from the facts stated in this memoir, that if the communication is to be re established between the two seas, through the Nile, a railroad would probably be preferable to a canal as a means of accomplishing this object. But M. le Père does not hesitate to assert the practicability of conducting a ship canal from Suez through the Bitter lakes to the Mediterranean. This canal would follow the same route as the ancient canal from Suez to the Nile, as far as the Bitter lakes. It would then proceed in a northern direction to the mouth of the eastern or Pelusiac branch of the Nile. It would here encounter a difficulty which might at first sight appear insurmountable; that is, the want of a good port on the coasts of the Mediterranean. General Andreossy, in his memoir on the lake of Menzaleh, read before the Egyptian Institute, has shown that Damietta, and all the other ports on the shores of the Delta, in that direction, are very difficult of access, on account of the constantly accumulating banks or bars formed by deposites of sand at the different mouths of the Nile. It was this circumstance which determined Alexander, with that unerring sagacity which guided all those actions of that conqueror which might justly entitle him to the name of Great, to found the city destined to perpetuate the glory of his name, and to become the channel of commercial intercourse between Europe and India to the west of the mouth of the Nile, where the only safe and suf-

ficient harbor was to be found. Had he been acquainted with the improvements in the art of hydraulic construction which have been developed in modern times, he would have founded this great commercial capital at the eastern mouth of the Nile, so as to connect it directly with the Red sea at Suez. The formation of an artificial port, and securing it against being chocked up, is an easy achievement to the modern engineer. The distance from Suez to Tineh, (the ancient Pelusium,) according to M. le Pére, is only 120 kilometres, or about 75 miles, being considerably less than the route of the ancient canal from the Red sea to the Nile. Of this distance 40 kilometres consist of the bed of the Bitter lakes, which would require but little excavation, and the lake Menzaleh, which might also be appropriated in the same manner. The waters of the Red sea at Suez being at least 8 metres more elevated than those of the Mediterranean, the proposed canal might be amply fed from these waters, which would thus be poured out into the Mediterranean through an artificial river, with a descent of thirty feet in a distance of only about seventy-five miles, and running with a steady velocity capable of being regulated by locks and sluices at any part of its course from south to north. The effect of such an immense volume of water would be powerful in contributing to the removal of the sand banks which now block up the Pelusiac mouth of the Nile, and facilitating the formation of an artificial harbor at this point. The transit for passengers, despatches, and goods, across the desert from Suez to Cairo, and thence down the Nile to its junction with the Mahondie canal, and thence to Alexandria, being a distance of 244 miles, including its different stoppages and transhipments, now requires four days of time, whilst the transit from Suez to Tineh would not require more than three hours. M. le Pére estimated the expense of the proposed canal at only seventy millions of francs. Supposing it should cost thirty millions on account of the hydraulic works necessary to be constructed on the shores of the Mediterranean, the outlay would be amply repaid by the vastly increased profits of the transit, from the tolls payable by East India ships passing through the canal. This new passage would then become what the passage into the Baltic through the sound and the belts has so long been to the kingdom of Denmark. It would furnish the Pacha of Egypt a more ample revenue than the gold mines of Nubia. The principal obstacles to the realizing of this project are not natural but political obstacles. France and Great Britain have been constant rivals for influence and power in Egypt, ever since the invasion of that country by Bonaparte; and especially since the rupture of the treaty of Amiens in 1803, which turned upon the *ultimatum* of the British cabinet demanding the possession of Malta, as a bulwark against the renewal of that attempt by the French, and as a consequent security to the British dominions in the East Indies. We have seen this rivalship again threatening to disturb the harmony of the two powers during the negotiations relating to the affairs of the east in 1840. In the meantime, the British had silently taken possession of Aden, at the mouth of the Red sea, one of the three important points in

created by the great Portuguese conqueror, Albuquerque, as essential to command and monopolize the commerce of the east.* But the occupation of Algiers by France was and still is contested silently, if not openly, by Great Britain, upon the ground that, if the French once gain a firm footing in this part of North Africa, it may ultimately lead the way to the re-conquest of Egypt. These mutual jealousies have been manifested in the divergent lines pursued by the British and French diplomatic agents respecting the question of the passage to and from India by the Red sea. But Great Britain and France are not the only powers interested in the question; and there is no reason why the Pacha of Egypt, as the vassal of the Porte, should not be encouraged to construct the canal, either for his own account, or by means of a chartered company of capitalists, for the general use and under the common protectorate of all the nations interested in the subject. It cannot be supposed that the enlightened cabinet of Austria, whose influence has ever been exerted in the most impartial and beneficient manner in all the political questions growing out of the affairs of the Levant, will suffer this matter to be finally settled, without its powerful interference to prevent the Egyptian passage from falling under the exclusive control of any one nation. Venice has fallen from that high and palmy state of prosperity which she once derived from monopolizing the commerce of the east, carried on through Egypt; but Trieste has taken, and more than fills, the place once occupied by that celebrated republic in the commercial world. It is the policy of the Austrian government to second, by every possible means, the enterprising spirit which animates the merchants of Trieste. One of the most powerful of these means is the encouragement of its intercourse by steam navigation with Egypt and the other countries of the Levant.

We have accordingly seen the deep interest taken by the Austrian statesmen in this subject, connected as it is with that of the British East India mails to and from Egypt across the continent of Europe. The recent passage of Mr. Waghorn from Bombay to London, via Trieste and Ostend, was intended to illustrate the comparison between the respective advantages of the overland routes through Germany and through France. This problem cannot be completely solved until the railroad communications from Calais to Marseilles, and from Trieste to Hamburg and Ostend, shall be completed. The most strenuous efforts will doubtless be made by the French government to accelerate the construction of

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*These three points, as designated by Albuquerque's son, in his account of his father's life, were Malacca, the great centre of Asiatic commerce at that time, Ormus, at the mouth of the Persian gulf, and Aden, in the straits of Babelmandel. "Had the king of Portugal," says he, "secured himself a strong position by taking possession of Aden, as he has done of Ormus and Malacca, he might, by means of this dominion over the three seas, consider himself lord of the world, (as did Alexander when he reached the Ganges,) since, with these three keys, the passages are shut to all other nations." (Commentarios do Grande Affonso d'Albuquerque, vol. iv., p. 217.)

Albuquerque would have turned the course of the Nile into the Red sea, and thus converted the fertile delta of Egypt into a desert, in order to realize this gigantic project of commercial monopoly, and prevent the Venetians from trading with the East Indies through Egypt. See his remarkable address to his troops at the attack on Malacca. (Commentaries, vol. iii., p. 133.)

the line from Paris to Lyons; whilst, on the other hand, the British government may desire to have the choice of two overland routes, in case that through France should fail in consequence of war. The line of Austrian railways, which proceeds from Vienna as a common centre, is already completed as far north as Prague, and south to Grätz. Its prolongation to Trieste is encountered by the difficulty of surmounting the lofty summit of the Julian Alps—the *Simmering*. This difficulty will, however, soon be overcome by means which the present advanced state of science cannot fail to invent. The line from Prague to Dresden will be completed in the course of next year; that from Dresden to Berlin has been long since in use, and will be prolonged in a short time to Hamburg, so that the journey may be performed from the Atlantic to the North sea in fifty-six hours.

Parallel with this railroad communication between the Adriatic sea and the German ocean is a water communication recently opened between the latter and the Black sea. I refer to the canal constructed under the auspices of the present king of Bavaria, and designed to connect the waters of the Mayn, which falls into the Rhine at Mayence, with those of the Danube. I have had repeated opportunities of examining this canal, during some of those numerous journeys undertaken with the view of studying the resources of the different German states associated in the *Zollverein*, the results of which have been communicated from time to time to the department. This great hydraulic work, which thus forms a continuous water communication between the rivers falling into the German ocean and those which flow into the Black sea, was among the grand projects conceived by the genius of Charlemagne. The *Ludwig* canal communicates at Bamberg, whence it runs south, and parallel with the little river Regnitz, a tributary stream of the Mayn, and, passing by the industrious town of Nuremberg, reaches the waters of the Altmuhl, which flow into the Danube at Kellheim. The whole distance from Bamberg to Kelheim is about 112 English miles. The Altmuhl has been deepened, embanked, and furnished with locks, by means of which it is rendered navigable to Dietfurth, where the excavation of the artificial canal was commenced at this end. The canal is 300 feet, at the summit level at Neumarkt, above the level of the Danube at Kellheim. Its dimensions are 54 Bavarian feet wide at the top, and 34 feet at the bottom. It has ninety-four locks, each being from 88 to 108 feet long, and 66 feet wide; several well built viaducts of great magnitude; and traverses, near Niederoelsbach, a tunnel 900 feet in length. The difficulties presented by the natural features of the country have been overcome with admirable skill by the engineers employed in the work, every part of which is constructed with the greatest strength and beauty.

The Danube being thus connected with the Rhine, it may be presumed that the natural obstacles which still impede the navigation of the latter river below Vienna will at last be removed under the administration of that enlightened and enterprising Austrian statesman, Baron von Kubeck, under whom the material interests of the empire have received a new and more energetic impulse. The

political obstacles to the free navigation of the Danube have already been removed by the treaty of 1840, between Austria and Russia, the advantages of which are extended to all nations which have a right to navigate the Black sea. The freedom of navigation of the Vistula, the Elbe, the Weeser, the Scheldt, the Rhine, and all the other rivers which form the great avenues to commercial intercourse with Germany and the neighboring countries, was established by the Congress of Vienna in 1815. But the navigation of these rivers is still subjected to excessive tolls and transit duties; and that of the Elbe especially remains subject to the tolls levied by the Hanoverian government, at Stade, on the cargoes of all vessels proceeding to and from Hamburg, except those of that city, in manifest violation both of the letter and spirit of the public law of Germany and Europe. In my former despatches I have repeatedly called the attention of the department to this subject of the *Stade* duties in connexion with the commercial rights and interests of the United States.

Increased facilities have thus been given to the commercial intercourse of the United States and other transatlantic nations with Germany and the other countries of central Europe. These facilities would be still more increased by the establishment of regular lines of steam packets between the United States and some port or ports in the British channel and the North sea. These packets would serve not only for the transportation of passengers and letters, but also of the finer and more valuable manufactured goods; and at the same time would be connected with the lines of communication already mentioned with the East Indies. The commercial and political interests of the United States require the establishment by the government, or under its protection and patronage, of such a line of packets, which might touch at Cowes or Havre, and then proceed to Antwerp, Bremen or Hamburg, as might be thought most expedient. The Belgic government, in the navigation treaty recently concluded with the United States, has stipulated for exemption from duties of American steam packets arriving at Antwerp; the Senate of Bremen has proposed to concede a similar exemption for that port, which has already such important commercial relations with the United States, and there can be no doubt that the Senate of Hamburg and the French government would cheerfully enter into similar stipulations. Not only the interests, but the national honor of the United States, imperiously demand such an establishment. During the diplomatic employments with which I have been so long honored by the favor of my country, I have been constantly mortified by the dependence in which our foreign agents are left upon a foreign and rival, though friendly government, for the transmission of their correspondence. The only mode of putting an end to a dependence which is both humiliating and inconsistent with the public interests, is to provide packets and couriers of our own, by which our government despatches may be forwarded to and from Europe and the different ports of the European continent. The heavy postages now paid on private correspondence between the United States and the European continent

might also be materially diminished by this means, combined with postal conventions with France, Belgium, and the different German states.

In making a choice of the port which should form the first terminus of the line of steam packets between the United States and the north of Europe, the superior natural advantages of the English harbors in the channel over those of France on the opposite coast must be taken into consideration. This superiority of maritime position constitutes one of the principal elements of the superior maritime resources and power of Great Britain when compared with her great rival. The harbor of Portsmouth, in particular, forms an immense natural basin, land-locked on all sides, and completely sheltered both against enemies and storms; and which, together with the passage between the Isle of Wight and the main land, including the roadstead of Spithead, is accessible in any weather and at all times of tide. The steam packets intending to touch at an English port in the channel, might take a pilot at the Needles, and run up to Cowes roads, where the passengers and mails destined for England could be immediately landed on the opposite shore at Southampton, and reach London in two hours by the railroad, whilst the packets would proceed without the least delay by the eastern passage on their voyage up the channel. Should the weather prove favorable, they might cross the channel, and land the passengers and mails destined for France at Boulogne. On the contrary supposition, these passengers and mails might await a more favorable opportunity of proceeding to one of these ports by the English steamers which are constantly plying from Southampton, and would land them in France in eight hours. But neither of these ports possesses the natural advantages of those on the English coast; whilst Cherbourg, though equally accessible at all times of tide, is liable to similar perils with those which environ the whole of the French coast on the channel, and which induce all navigators up and down the channel to avoid approaching it, whilst they constantly keep as near as possible to the English coast.

We thus see how the new means of intercourse between Europe and the East Indies would become connected with those between Europe and the United States, so as to form one uninterrupted chain of communication by land and water, and by steam power between New York or Boston, and Bombay, which would be protracted, by means of the British steamers, to Calcutta, Singapore and Canton. Allowing one month for the passage from Bombay by the Red sea, Egypt, and the Mediterranean, and overland, to some port in the British channel, and ten or fifteen days for the voyage across the Atlantic, and the result would be that passengers and despatches might be transmitted by this route between the United States and India in six weeks.

In calculating the distance from the French ports in Europe to those in the East Indies, by means of the proposed canal to connect the waters of the Mediterranean with those of the Red sea, in comparison with the present route by the Cape of Good Hope,

the distinguished French engineer before mentioned, M. le Père, computes the distance from Marseilles to Pondicherry, by the Egyptian route, at 2,400 leagues, and from l'Orient (the port from which the French East India trade was formerly carried on) to Pondicherry, round the Cape of Good Hope, at 4,700 leagues, thus making a gain of 2,300 leagues in point of distance. He computes the time necessary to perform the voyage by the Mediterranean and Red sea at from ninety-five to one hundred and five days, and by the great ocean at from one hundred and thirty to one hundred and fifty days; making a difference in favor of the former route of from thirty-five to forty days. This calculation was of course applicable to the ordinary methods of navigation with sails. Our Fulton had not yet demonstrated by actual experiment the practicability of propelling vessels by steam; and at the very time when his propositions for this purpose were made to and rejected by the French government, when he was treated by the Academy of Sciences as a dreamer, and that mocker of all generous and enlightened enthusiasm, Talleyrand, could quote the Bible against his theory, as the Inquisitors quoted it against that of Galileo, M. le Père dwelt upon the circumstance of the prevalence of the periodical monsoons in the Red sea and the Indian ocean as a formidable impediment to their navigation, and as a serious objection to the project of re-establishing the communication to India through Egypt, by reconstructing the ancient canal from the Nile to Suez. He states, as a ground of preference in favor of the projected new canal from Suez to the Mediterranean, besides the necessity of the transhipment of the cargoes both ways at Suez, and at Alexandria, (since the communication by the canal and the Nile could not be made sufficient to admit the passage of large ships,) and the fact that the river is only navigable, even with ordinary vessels, from August to March, at which season only the canal could receive an adequate supply of water, and consequently could only be navigated during that period, and although the latter part of the summer monsoon from April to October, which blows down the Red sea, and is consequently favorable to the navigation from Egypt to India, coincides with the rise of the Nile and the period when the river and the canal would both be navigable, yet the winter monsoon, which is favorable to the navigation up the Red sea, would bring the vessels from India to Suez at the season when the canal and river would no longer be navigable, and would consequently require a deposite of the goods at Suez to await the next season for their transportation to Alexandria. All these apprehensions from the monsoons have disappeared before the power of steam, directed by the hand of genius, and overcoming all obstacles opposed by the elements to maritime navigation.

We have already seen what are the advantages to be derived by the western world in general from the re-establishment of the ancient commercial route to the East Indies through Egypt. If a comparison be made of what Europe and the United States would respectively gain by the opening a direct communication between the Atlantic and Pacific oceans through some part of the isthmus

which connects the two American continents, the relative circumstances of these two great commercial communicaties must be taken into consideration. Alexander Von Humboldt has very justly observed, "that the relative advantages of the present route to the East Indies, to the Cape of Good Hope, or Cape Horn, and a communication to be opened by means of a ship canal through the American isthmus, would be very differently estimated by the English and by an American merchant; by the navigator who seeks only direct intercourse with the East Indies and China, and by him who would carry on that intercourse indirectly by touching and trading at intermediate ports on the western coasts and at the isles of the Pacific ocean." That great geographer calculates the sailing distance from London to Nootka sound, on the northwest coast of America, by Cape Horn, at 5,000 marine leagues; that from Boston to Nootka sound, by the same route, at 5,200 marine leagues. By the canal of the isthmus the distance would be 3,000 from London to Nootka sound, and 2,100 from Boston. The distance would therefore be shortened for vessels that proceed to the northwest coast of America to seek for furs on their way to China from Europe 2,000, and from the United States 3,100 marine leagues.

If, however, according to the same authority, the *direct* intercourse with the East Indies and China be considered, the gain to be produced by opening such a communication between the two oceans would be much less both to Europe and the United States, but more to the latter still, than to the former. The sailing distance from London to Canton, by the Cape of Good Hope and twice crossing the equator, Humboldt estimates at 4,400 marine leagues; that from Boston to Canton, by the same route, at 4,500 marine leagues. By the proposed ship canal through the American isthmus, the distance would be 4,800 and 4,200 respectively, keeping constantly north of the equator. In point of time he estimates the voyage from the United States to China, by the Cape of Good Hope, at an average of one hundred and twenty days; that from England to China, by the same route, at one hundred and thirty days. According to the analogy of the average voyages from Boston and from Liverpool to the eastern coast of Central America, and from Acapulco to Manilla, the entire voyage to Canton, by the projected canal of the American isthmus, may be estimated at one hundred and five days from the United States, and at one hundred and fifteen days from England. The entire course of the voyage in the Pacific ocean would be north of the equator, where the prevalence of the easterly trade winds renders the navigation to the coast of Asia extremely favorable. In sailing from Acapulco to the Philippine islands, the Spanish navigators formerly allowed themselves to be wafted along on the same parallel by the winds and currents, which speedily drove them to their destined port; whilst on their return voyage to Mexico, they ascended as far north as Tappan, and then steered directly for the coast of California. Humboldt expresses the opinion that a maritime nation like Great Britain, which possesses such important intermediate stations as the Cape of Good Hope and the Isle of

France, will always prefer, so far as the *direct* intercourse is concerned, the old sea route to the East Indies from west to east, to any new passage which may be opened between the two American continents. The same remark, he thinks, may be applied to the restoration of the primitive route by Egypt. Such a great maritime power as the one in question would probably use this passage as she now does, principally for the transmission of despatches and passengers, whilst all bulky merchandise would still continue to be transported between England and India by the Cape of Good Hope. The route by the Mediterranean and the Red sea would be the most important, so far as respects the direct intercourse to France, Austria, and such other European states as have ports situated on the coast of the Mediterranean. It would be, above all, most important for any Christian power that might possess itself of Egypt, and revive the flourishing state of prosperity that happily situated country enjoyed under the Pharoahs, the Ptolemies, and the Arabian caliphs, and which was principally owing to the opulence diffused by the commerce between India and Europe, almost exclusively carried on through its ports on the Mediterranean and the Red sea.

It must, however, be remembered that these observations as to the Egyptian passages were written by Baron Humboldt previous to the successful application of steam power to maritime navigation, and that the construction of a ship canal through the isthmus of Suez, of sufficient capacity to allow the passage of East Indiamen of the largest size, would entirely change all the elements of the question.

But whatever doubts may exist as to the relative advantages of shortening the passage to the East Indies from west to east, to the different nations interested in the commerce of Asia, there can be none as to the advantages which would be derived to the United States from shortening the passage from east to west. In this question is involved not only the direct, but the indirect intercourse with the East Indies. Europe seeks to avoid the lengthened route round the Cape of Good Hope by connecting the Mediterranean with the Red sea and the Indian ocean. We must seek to avoid the lengthened route round Cape Horn by connecting the Caribbean sea with the Pacific ocean. We have seen that the French engineers who planned the proposed canal across the isthmus of Suez calculated that it would save one-third the distance, and one fifth the time in navigating from France to her possessions on the Coromandel coast of India. The United States would save at least ten thousand miles of distance, and a proportional amount of time in their navigation to China, touching at the northwest coast of America, and in the Polynesian islands, by substituting the route across the isthmus which connects the two American continents for that round Cape Horn. The opening a water communication from one sea to the other thus becomes a matter of vital importance to us. Our national interests, commercial, political, and social, are all involved in the question. The necessity of competing with other rival nations for the new trade now opened with

the "Celestial Empire," from which the veil of mystery has been rudely withdrawn, and which has been compelled to abandon its anti-social principles of non-intercourse with foreigners; of extending our established commerce with the western coasts of the two American continents, and the Polynesian archipelago; of giving increased facilities to the whale fishery, and of establishing a more convenient communication by sea with our territories beyond the rocky mountains, and our naval stations in the Pacific ocean—all these circumstances combine to augment the importance and urgency of this great question. A new and vastly increased interest has been given to the subject by the measures adopted by our government for establishing diplomatic intercourse with China and the independent isles of the Pacific, and by the extended schemes of colonization recently developed by Great Britain and France in Australasia, New Zealand, the Marquesas, and Tahiti. It is not meant that the United States should seek exclusive advantages for their government or citizens. Such artificial communications between the continents of both hemispheres ought to be free, like the natural passages of the straits, the sounds, the gulfs, and the great rivers which wash the shores of different countries. The hydraulic works to be constructed for these purposes ought to be considered as held in trust by the nation within whose territory they are established for the common use of all mankind. There is surely enough of the spirit of mutual concession, of respect for the public law of the civilized world, and of political wisdom among the maritime powers principally interested, to devise regulations by which the passage of the American isthmus, once established, may be neutralized and enjoyed in common by all nations, upon the payment of moderate and reasonable tolls, according to the just and equitable principles laid down by the congress of Vienna, in respect to the navigation of the great European rivers. The philanthropist will not readily yield to the disconsolate theory that "nations may combine to oppress and plunder, and but rarely unite for any useful and benevolent purpose." The history of mankind, and especially in more recent periods, when experience has at last opened the eyes of nations to the folly of pursuing a policy merely selfish, attests that sovereign states, blessed with enlightened governments, however various their forms, may be induced to unite in respect to purposes in which the interests of all are combined for the general good. It is not by pursuing an insulated and anti-social policy, that the United States can hope to accomplish those truly glorious destinies which it is fervently believed Providence has reserved for them. Our law of nations is the European law of nations—of that enlightened portion of the globe from which we derived our origin, our religion, our civilization, and our spirit of freedom. The different communities of the civilized world are now, more than ever, bound together by the ties of mutual interest—by the consciousness of the evil they may mutually inflict in war, and of the good they may impart to each other in peace. No nation can with impunity separate itself from the great society of

nations, any more than an individual can separate himself with safety from the particular society of which he is a member. Whilst, therefore, we repel any attempt on the part of other nations to interfere in our internal concerns, let us not hesitate to co-operate with them in the accomplishment of any great work, either of benevolence, or of enlightened selfishness, in which we have a common interest with the rest of mankind.

Such, then, being the vast magnitude and urgency of this question, I have thought that a concise summary of the present state of our information respecting it, so far as it may be derived from sources accessible here, might be acceptable to the government at the present eventful moment. If some coincidences should be found in the contents of this despatch with those of a letter on the same subject which I transmitted to the institute at Washington in 1843, and which appeared in the *National Intelligencer* of the 19th of August of that year, they will, I trust, be excused as unavoidable, whilst the defects of that communication will have been supplied by more recent and more authentic information since collected.

It is well known with what intense and painful anxiety the great Columbus sought to find a passage, through the vast continent discovered by him, to the land of Cathay. The Emperor Charles V., in a letter written in 1523, from Valladolid to Cortez, enjoined him to search carefully on the eastern and western shores of New Spain for "the secret of a strait," (*el secreto del estrecho*,) of which Cortez himself had spoken in one of his previous despatches to the emperor, and which, it was supposed, would shorten, by two-thirds, the route from Cadiz to the East Indies—then called "the land of spices." The conquerer of Mexico, in his answer to the emperor, speaks with the most glowing enthusiasm of the probability of such a discovery, "which," says he, "would render your majesty master of so many kingdoms that you might consider yourself lord of the world." It was in the attempt to find a shorter route to the East Indies that Magellan discovered the passage round Cape Horn through the straits which bear his name, whilst Cortez spent the remainder of his restless and laborious life in vain endeavors to the same end. After the great deeds he had achieved in the conquest of Mexico, the accidental discovery of the gulf and peninsula of California could hardly be considered as an adequate compensation for the toils and perils he endured in his maritime expeditions on the coast of the Pacific.

Since it has been completely ascertained that there is no natural water passage through the American continent from the Arctic sea to the straits of Magellan, various points have been indicated by which an artificial communication might be opened between the two oceans. Five of these points are enumerated by Humboldt, as follows:

1. The isthmus of Tehuantepec, between the sources of the Rio Chimalapa, which falls into the Pacific ocean, and the Rio del Passo, which falls into the Rio Huasacualco; which last falls into the Atlantic.

2. The isthmus of Nicaragua, between the lake of that name, forming the sources of the Rio San Juan, which falls into the Atlantic ocean, and the Gulf of Papagayo, on the Pacific.

3. The isthmus of Panama.

4. The isthmus of Darien, or Cupica.

5. The isthmus between the Rio Atrato, which falls into the Atlantic ocean, and the Rio Choco, which falls into the Pacific.

1. The isthmus of Tehuantepec is formed between the 16th and 18th degrees of north latitude, by the Rio Chimalapa flowing into the Gulf of Tehuantepec on one side, and the Rio del Passo, which afterwards becomes the Rio Huasacualco, into the Gulf of Mexico on the other.* It has been pretended that these rivers are sometimes swollen by the rains, so as to admit of a passage for Indian batteaux from sea to sea, like those temporary communications which are sometimes formed between the waters of the Mississippi and those of lakes Erie and Michigan. Be this as it may, it is certain that a commercial communication has long been carried on through this valley across the isthmus, and especially at those periods of war when the trade of Vera Cruz was interrupted by military and naval operations. The mouth of the Rio Huasacualco forms the best harbor known to exist at the mouth of any river on the Gulf of Mexico, it being well known that Pensacola is situated on a bay. This river has eighteen or twenty feet of water on the bar at its mouth. It is navigable for eight leagues to the Passo de la Fabrica, where it is joined by the Rio del Passo, and where the cargoes are taken out and transported in boats fifteen leagues higher up to the Passo de la Puerta, at which place the river ceases to be navigable with boats. From this place the goods are transported by land to the bay of Tehuantepec, on the Pacific.

In pursuance of his ardent desire to find "the secret of a strait" through the American continent into the Pacific ocean, Cortes demanded, in 1520, from Montezuma, information concerning the eastern coast of the empire of Anahuac. The Mexican monarch answered that he was not himself acquainted with those parts, but that he would cause a drawing to be made of the coast, with its bays and rivers, and would furnish the necessary guides to accompany the Spaniards who might be sent to explore the country. The next day the drawing was accordingly brought to Cortes, upon which his pilots recognized the mouth of a great river, which they supposed to be the one they had perceived on the coast on their first arrival, near the mountains of Sanmyn, in the province of Mazamalco. Guided by these indications, Cortes sent, in 1520, a small detachment under the orders of Diego Ordaz, to reconnoitre this river, which proved to be the Huasacualco, or, as Cortes writes the Mexican word, *Quacalco*. The pilots found only two and a half fathoms of water on the bar at its mouth, but on ascending the river the depth of water increased to five or six fathoms. Afte

* Humboldt's Voyage, &c., tome IX., p. 209. Essai sur la Nouvelle Espagne, tome I pp. 209-237.

tablishing of Mexico, the conquest of the province of Tehuantepec was accomplished by Gonzalo de Sandoval in 1521; and although it had been ascertained by the pilots that no strait existed from the coast of Nicaragua to the isthmus of Tehuantepec, this isthmus still continued to be regarded as of great importance, on account of the proximity of the two seas, and the river Huasacualco affording the Spanish conquistadores the facility of transporting from Vera Cruz to the coasts of the Pacific ocean the necessary materials for ship building. The expedition of Hernando de Grixalva, which sailed for California in 1534, was equipped at Tehuantepec, and the vessels in which Cortes himself sailed from Chametla in 1535, for the same destination, were also constructed at the mouth of the Rio Chimalapa with materials brought from the gulf of Mexico by the Rio Huasacualco.

From the latter part of the sixteenth century the port of Tehuantepec, which is in fact only an open roadstead, was but little frequented. Acapulco became the seat of the commerce between the Spanish American colonies and the Philippine islands; and the ships used in this trade were built either at San Blas or at Manila. The sea is found to be fast retreating from the coast of Tehuantepec, the anchorage becomes every year more unsafe, and the bar of sand at the mouth of the Rio Chimalapa is constantly augmenting.

The first exploration of this route for a canal communication between the Gulf of Mexico and the South sea, was occasioned by the accidental discovery, in 1771, of some pieces of bronze cannon in the castle of San Juan d'Ulloa, which it was ascertained by the marks had been cast at Manilla. As it was nearly certain that these pieces of artillery could not have been transported to the coast of the Gulf of Mexico by the way of Acapulco, on account of the difficulties of the overland communication over the high cordilleras of New Spain, nor by the way of Cape Horn or the Cape of Good Hope—the trade between Vera Cruz and the Philippine islands not being carried on by either of those routes—the conclusion was that they must have found their way by the isthmus of Tehuantepec. This conjecture was verified by the examination of ancient records, and the tradition existing among the inhabitants of the isthmus, that these cannon had been transported to the Pacific by the Rio Chimalapa and the Rio Huasacualco. This fact, thus ascertained, induced the viceroy of Mexico, Don Bucarelli, to give orders to two engineers, Don Antonio Ulloa and Don Miguel del Corral, to examine the isthmus, with the view of ascertaining whether any natural communication already existed by means of rivers whose branches might interlock with each other, and at the same time to determine the practicability of opening an artificial canal between the Chimalapa and Huasacualco. Mr. Humboldt prepared his map of the isthmus of Tehuantepec from the report of these engineers, who found that there was no river which discharged its waters at the same time into the Atlantic and the Pacific; that the river Huasacualco did not take its rise, as the viceroy had been assured, near the city of Tehuantepec, but

that in ascending that river above the falls, even to the ancient *Desembarcadero* of Malpasso, the coasts of the Pacific were still twenty-six leagues distant. They observed that a chain of mountains of considerable height divides the waters which flow into the two seas. This small cordillera stretches from east to west from the Cerros de los Mixes, then inhabited by savages, towards the elevated plain of Portillo de Patapa. But the engineer Cramer affirms, that to the south of Santa Mareda de Chimalapa, the mountains form, not a continuous cordillera, but a group, and that there exists a transversal valley, through which a canal might be constructed, without locks or inclined plains, to communicate between the two seas, at a distance of not more than six leagues in length.*

In the year 1814, the Spanish Cortes, on the motion of Don Lucas Alaman, afterwards Mexican minister of foreign affairs, passed a decree for the construction of such a canal. The subsequent independence of the Spanish American colonies prevented any measures being taken in execution of this decree; but the government of the United States of Mexico, under the presidency of General Guadaloupe Vittoria, appointed a board of commissioners to ascertain the practicability of constructing a canal from the one river to the other, and of removing the obstructions which exist to the navigation of the two rivers by vessels of considerable burden. The result of their investigations, conducted under the directions of Colonel, now General Orbegozo, tended to show that the want of a good harbor on the coast of the Pacific, at or near the mouth of the Chimalapa, with the great number of rapids in the rivers winding through an isthmus of thirty-eight leagues in breadth, and the intermediate elevations to be surmounted, rendered impracticable the execution of a ship canal at this point, although the commerce already carried on across the isthmus might doubtless be greatly facilitated and extended by means of good roads. The Mexican congress, therefore, determined on the construction of a new road to connect the upper waters of the Rio Huasacualo with the lagoons to the east of Tehuantepec. It is more than probable that the subsequent unsettled state of the affairs, both internal and external, of the Mexican republic, has prevented anything being done towards carrying this resolution into effect.

Very different results appear to be presented by a more recent exploration of this route, undertaken in consequence of a charter granted by the Mexican government to Don José de Garay. The exploration was conducted by a scientific commission, composed of a chief engineer, Don Gaëtan Moro, Captain Robles, professor in the military school of Mexico, of Captain Gonzales and Lieutenant Güido, of the Mexican navy. The report of this commission, drawn up by Moro, states the elevation of the culminating point near Terrifa, on this route between the two seas, as ascertained by barometrical observations, at 200 metres, instead of 393, as represented by General Orbegozo. He supposes that this elevation might be reduced to 175, or perhaps to 150 metres, by means of a deep cut,

* Humboldt, Essai Politique, tome I, p. 209; tome IV., pp. 49-54.

which would render the execution of the locks necessary for a ship canal quite practicable. But it would require at least *a hundred of these locks*, which could not be constructed at a less expense than forty millions of francs. The supply of water from the neighboring streams appears to be ample to feed the canal. On the side of the gulf of Mexico, the mouth of the Huasacualco affords a port sufficient for the entry and shelter of the largest vessels. On the coast of the Pacific ocean, the depth of the lagoons near Tehuantepec is almost everywhere from five to six metres, but the Bocca Barra, by which these lakes are emptied into the ocean, is obstructed by a sand bank, which might, however, easily be removed, and a good port thus constructed. The entire breadth of the isthmus, in a straight line between the two seas, is 220 kilometres, but the lagoons would reduce this distance by 20 kilometres; and the Huasacualco, which is navigable in a considerable part of its course, might, with the aid of some improvement by artificial means, be rendered entirely so from its confluence with the Malatengo, from which it flows to the sea with a moderate current. Thus the canal, descending from the plain of Tarifa southwardly into the lagoons, and northwardly to the junction of the Huasacualco with the Malatengo, would be only 80 kilometres in length. In addition to this length of the artificial canal, the line of communication would include the lagoons and 258 kilometres of the course of the river Huasacualco. It would thus be about 100 leagues in length, that is, much more than the passage by the isthmus of Panama, but considerably less than that by the lake of Nicaragua. The country is thinly peopled, but is represented to be remarkably healthy on the *versant* towards the Pacific, whilst towards the gulf of Mexico it is free from the yellow fever and other diseases usually found to prevail on the coasts of that sea.

2. The great lake of Nicaragua communicates to the east with the Caribbean sea by the river San Juan del Norte. An artificial communication may be opened between the lake and the Pacific ocean, by cutting a canal through the isthmus which separates them.

That distinguished Prussian geographer, Berghaus, in a memoir published in 1838, and intended to illustrate his beautiful maps of Central America, has traced with the hand of a master the great physical features of this region of the globe.* He refutes the notion constantly repeated in the geographical treatises and maps in ordinary use, according to which the whole extent of this narrowest part of the continent is traversed by a continuous, unbroken chain of mountains, without transversal valleys, which bars the passage across the isthmus. This mistaken opinion, which had been already contested by Humboldt, doubtless originated from the long succession of volanic mountains which rise along the flat shores of the Pacific, and from which it has been inferred that they stand, as in Chili, Bolivia, and Quito, on the ridge of the Cordil-

* Berghaus, Annalen der Erd-Völker und Staatenkunde, 3te reihe, band V., s. 221. See the map transmitted with this despatch.

lera. In Guatemala this is not the case. The coast of the South sea forms here an alluvial plain of various breadth, from which the volcanic hills rise in insulated groups detached from the back ground of mountains. Such is the character of the volcanic hills between the lake of Nicaragua and the Pacific ocean.

Instead of this imaginary continuous cordillera, the mountains of Central America are divided by Berghaus into three distinct systems or groups. The first is the group of Costa Rica; the second that of Nicaragua and Honduras; and the third that of Guatemala.

The first of these is divided from the second by the great transversal valley, of which the lake of Nicaragua forms the middle point, and which extends from sea to sea. The second is divided from the third by the Llanura de Comayagua, another wide transversal valley, which traverses the continent in the meridian of the Gulf of Conchagua, in a direction from northeast to south. This fact, which Humboldt had conjectured in 1825, was verified by Don Juan Galindo ten years later. Through this plain flows the Rio Jagua towards the north-northeast into the Caribbean sea, and the Rio Sirano, or San Miguel, into the gulf of Conchagua, on the Pacific. Both these streams are navigable by batteaux.

On the isthmus of Panama, between the river Chagres and the coast along the shores of the Atlantic, nothing is to be seen rising above the plain but hills of moderate elevation. But when the traveller reaches the meridian of the Rio Coclet, about seven leagues from the coast of the Caribbean sea, he encounters the lofty mountains known to mariners by the name of the *Cordillera de Veragua*. This group may be descried in clear weather at the distance of thirty-six leagues at sea. Humboldt conjectures its highest point of elevation to be about 1,400 toises. Among these mountains takes its rise the Rio Belem, at the mouth of which Columbus established, in 1502, the first European colony ever planted on the American continent. Under the parallel of eight degrees and twenty-five minutes north latitude, begin the secondary highlands of Costa Rica, which form an elevation of about 800 toises, and gradually decline in successive terraces, girt with volcanoes, until they sink down to the level of the lake of Nicaragua.

The third group of mountains described by Berghaus is that of Guatemala, which fills the whole western part of Central America and the eastern States of Mexico, to the isthmus of Tehuantepec, before noticed. The whole coast of the bay of Honduras, from the meridian of the island of Utila to the parallel of the Belize, is girt with lofty mountains. Captain Owen determined the height of the Congrehoy peak to be 1,170 toises, and that of Omoha 1,095 toises above the level of the sea. The Belize river bursts forth from these mountains in foaming cataracts. In one place the stream is arched over by a natural bridge, through which it rushes over a waterfall of from forty to fifty feet high. Many other rivers along the coast are adorned with similar natural grottoes, through which they pass on their way to the sea. Along the coast run two ridges, one of which is called the Pine ridge, and the other the Cahoon

ridge. The first forms a vast, boundless natural park of pines, shooting from the soft, verdant turf. The second is crowned with a wood of gigantic forest trees of various descriptions, besides the mahogany (*swietenia mahagoni*) which forms the principal wealth of this region. Through this wilderness a single path leads up a narrow valley to the lake of Peten, on the northern prolongation of the table land of Guatemala. The Rio Montagua forms another deep sunken valley, which conducts first to the old, and then to the new city of Guatemala, which last, according to Thompson, stands only 1,800 feet above the level of the sea. But the cities of Guatemala do not stand on the highest point of land. Still more lofty are the mountains of Chemaltenango, with their magnificent scenery, and higher still the mountain plains of Sosola, Quesáltenango, and Totonicapan. On these plains, wheat and other breadstuffs are cultivated in perfection. Here is the highest point of elevation, called by the natives themselves "the highlands." Here, too, is the central region of the volcanic fires. The two ranges of these volcanic mountains, called the *volcanos de los Amilpas*, run along the very edge of the table land. According to Captain Basil Hall's observations, these mountains rise about 2,000 toises above the level of the sea. As in the east, towards Honduras, so in the west towards the Gulf of Tehuantepec, the plain is girt with a chain of mountains, from which the Rio Umusiata bursts forth, and running north, after passing a single cataract, becomes navigable quite into the Gulf of Mexico.*

To return to the lake of Nicaragua. The isthmus which divides that lake from the port of San Juan del Sud, on the Pacific ocean, is said to be about seventeen English miles in breadth. According to the observations made by the Spanish engineer Galisteo, in 1781, the level of the Nicaragua lake is 134 feet above the Pacific ocean.† The elevation of this basin above the neighboring seas is a fact so well known that it has been considered by some as an invincible obstacle to the execution of a ship canal at this place. It has been apprehended that it might occasion a sudden rushing of the waters to the westward, or a diminution of the waters in the Rio San Juan, the navigation of which is impeded by several rapids. But even supposing a considerable permanent difference of elevation between the two seas, which, as it will be hereafter shown, does not exist, the art of the engineer would easily apply a remedy for the apprehended danger of inundation, by means of locks, whilst the lake would serve as a reservoir to supply both the canal and the river.

A series of tables is given in Thompson's Travels in Guatemala of levels, repeated at intervals not exceeding 100 yards apart, between the southern shore of Lake Nicaragua and the Gulf of Papagayo, from which the author infers the elevation of the surface of the lake above the Pacific ocean to be 133 feet 11½ inches, and the greatest height of any part of the intervening land to be only 19

*Berghaus, Annalen der Erd-Völker und Staatenkunde, 31 reihe, band V., s. 221.
†Humboldt, Voyage, &c., t. XI., p. 120, note.

feet 1 inch above the lake. But Mr. Mercer has shown, in his report made to the House of Representatives in 1839, that Thompson mistakes the true import of the tables in substituting the comparative elevation of two contiguous stations on the long series of levels for the highest rise above the lake; for the first nine miles and seven hundred yards from the Pacific, the ground is not found to rise above the level of the lake. The difficulties attending the construction of a continuous canal on this route are confined to the seven or eight miles next to the lake, for about six miles of which the ground rises to an elevation exceeding 60 feet; for two miles of the six it averages 135 feet, and for one-third of a mile 150 feet. If the level of the lake be assumed for the summit of a canal, there must be added to the elevation above mentioned an excavation of the depth of the channel for navigation.

Besides this communication from Lake Nicaragua to the Gulf of Papagayo, there is a possible choice of two others: 1st, by the adjoining lake of Leon, or Montagua, by the Rio de Yosta, which flows from the volcanic mountain of Telica;* 2d, from Lake Nicaragua to the Gulf of Nicoya or Caldera.†

There seems to be no doubt of Lake Nicaragua being sufficiently deep for ship navigation. The river San Juan, which has its sources in the lake, runs southeasterly, and discharges itself into the Caribbean sea, in the latitude of 10° 45′ north, and 86° west longitude from Paris. The bar at the mouth of the river has not more than 12 feet of water on it, and it is stated by Mr. Robinson that one of the passages would admit a vessel drawing 25 feet. After the bar is passed, there is excellent and safe anchorage in four and six fathoms. The accounts as to the difficulties attending the navigation of the Rio San Juan, from rapids and sand bars, are somewhat contradictory; but it seems probable that these obstacles might be overcome by artificial works, so as to render that river navigable for large vessels in its whole course.

Soon after the independence of Central America was declared, in 1824, negotiations were entered into between the republic and several associations in the United States and England for the construction of a canal from the Lake Nicaragua to the South sea, and for improving the navigation of the Rio San Juan. These negotiations finally terminated in a charter, granted in 1826, for this purpose, by the federal congress of the republic, to Mr. Palmer, of New York, and his associates. This contract not having been carried into effect, another grant was made for the same purpose in 1830 to a Dutch company, under the patronage of the late king of Holland. The events consequent upon the Belgic revolution, which occurred in the same year, also prevented any measures being taken to carry into execution this arrangement.

*See some observations on this route by Chievalier Frierichsthal in the Journal of the Geographical Society of London, vol. IX., part 1, p. 76.

†And not from the lake of Leon to the Gulf of Nicoya, as Mr. Robinson has erroneously supposed.

3. The possibility of opening a canal communication between the two oceans across the isthmus of Panama, has occupied the minds of men almost ever since it was traversed for the first time, and the Pacific ocean was discovered by the intrepid and adventurous Nunes de Balboa. During the three centuries which have elapsed since this memorable epoch, neither the relative height of the two oceans, nor the elevation of the highlands between them, nor the geographical points of the isthmus, had been, until very recently, determined with any approach to mathematical accuracy. From very ancient times the prevailing opinion of mankind had assumed the hypothesis that of two adjacent seas, separated by a narrow isthmus, the level of one must necessarily be higher than that of the other. This supposition of the ancient geographers has been found correct as to the elevation of the Red sea above that of the Mediterranean. The Pacific ocean, at the isthmus of Panama, was also formerly supposed to be considerably higher than the Atlantic. This opinion was long since contested by Baron Von Humboldt, and his conclusions have been recently confirmed by the actual observations of Mr. Lloyd, made with the greatest accuracy and care, in 1828–'29, by order of General Bolivar.

As before noticed, it has been hitherto generally supposed that the mountains which traverse the isthmus of Panama form a continuation of the cordillera of the Andes, or a connecting link between that and the great chain of the Mexican and Rocky mountains. Mr. Lloyd has also confirmed the antecedent theory of Humboldt in this respect, and shown that the continuity of the chain is twice broken in its passage throughout the isthmus connecting the two continents. It ceases in Nicaragua, but again rears its lofty summits in the province of Veragua, (as we have seen from Berghaus,) where it is crowned with an extensive plain, called La Mesa. In the eastern part of this province it breaks into detached mountains of considerable height, and of the most abrupt and rugged formation. Thence proceeding still to the eastward, innumerable conical hills lift their heads three or four hundred feet high, with their bases surrounded by level plains and savannahs. Finally, about Chagres, on the Atlantic side, and the bay of Chorrera, on the Pacific, these hills also disappear, and the country for a few miles in extent sinks into low and level plains. Again three conical hills rise, and, becoming collected, form a small cordillera, running from about Porto Bello to the bay of Mandingo, where occurs the second break in the continuity of the mountain chain.*

The Rio Chagres, which falls into the Caribbean sea, to the west of Porto Bello, and at the mouth of which lies the town of Chagres, though obstructed in its ascent by sand banks and rapids, is navigable for vessels drawing from five to six feet of water to Cruces, about sixteen English miles in a direct line from Panama. From the mouth of the river to its junction with the Rio Trinidad, a distance of twenty-four miles, the Chagres has a depth of from twen-

* Journal of the Geographical Society of London, vol. I, p. 70.

ty-two to thirty feet, unless on some few spots, where only sixteen are found, which, however, have deep water close to them. This depth, too, is not a channel, but extends to the whole width of the river, which is from two hundred to two hundred and eighty feet wide. But this river is subject to the great inconvenience that vessels drawing more than twelve feet of water cannot enter the mouth of the river, at the port of Chagres, on account of a stratum of slaty limestone, which runs at high water at a depth of fifteen feet from a point on the main land, near the castle of San Lorenzo, to some rocks in the middle of the entrance of the harbor, and which, together with a lee current setting on the southern shore, particularly in the rainy season, renders the entrance extremely difficult and dangerous. Mr. Lloyd supposes that this difficulty may be obviated by substituting for the harbor of Chagres the bay of Limon, or Navy bay, which lies to the eastward of the town, and the coves of which afford excellent and secure anchorage in its present state, and the entire bay is capable of being rendered one of the most safe and commodious harbors in the world. This bay is approached so near by the river Chagres that it may easily be united with it by a canal something less than three English miles in length, over a flat country.*

The Spanish engineers who had proposed to the court of Madrid, as early as 1528, the establishment of a water communication across the isthmus by the river Chagres, intended to commence the artificial canal at Cruces, and conduct it from thence to Panama, over a country with the difficulties of which they do not appear to have made themselves sufficiently acquainted. The Rio Chagres is joined considerably below Cruces by another river called the Trinidad, coming from the south, which some consider as the main stream, and whose head waters approach very near to the bay of Chorrera, lying to the west of Panama, on the Pacific. The eastern part of the isthmus, on the line from Panama to the mouth of the Chagres, is narrower, but the country is much more broken and elevated in that direction. Mr. Lloyd, therefore, concludes that the valley of the Rio Trinidad affords the most favorable route for a canal which would unite the lower Chagres with the waters which fall into the bay of Chorrera. But his observations were principally directed to the object of opening a communication across the isthmus by means of railroads, and incidentally to determine the difference of levels between the two oceans. For this purpose he began his operations by taking a series of levellings between Panama and the upper Chagres, on the old road to Porto Bello. At the point where the road crosses the river, 22¼ miles distant from Panama, he found the elevation to be 169 84-100ths feet above the level of high water mark in the Pacific, the greatest intermediate height passed over being 633 32-100ths feet. He then descended the river to Cruces, and found in his route a total fall in the river of 111 60 100ths feet, being only 37 96-100ths feet above the Pacific.

* Report of Mr. Lloyd, Philosophical Transactions, 1830, part 1, p. 67.

From this place the river gradually descends to the level of the Atlantic.

The results of the observations made by Mr. Lloyd show, first, that the mean height of the Pacific at the port of Panama is 3 52-100ths feet higher than that of the Atlantic at the mouth of the river Chagres. Secondly, at high water, the time of which is nearly the same on both sides of the isthmus, the Pacific is raised at mean tides 10 61-100ths feet, and the Atlantic 58-100ths of a foot above their respective mean levels. The Pacific is therefore the highest at these periods. Thirdly, at low water mark, both seas are the same quantities below their respective levels. Therefore, at such times the Pacific is lower than the Atlantic.

In every twelve hours, therefore, and commencing with high tides, the level of the Pacific is several feet higher than that of the Atlantic; it becomes then of the same height, and at low tide is several feet lower. Again, as the tide rises, the two seas are of one height; and finally, at high tide, the Pacific is again the same number of feet above the Atlantic as at first.*

A separate plan of the river Chagres, from its mouth to the point where it was intersected by the levellings, was communicated by Mr. Lloyd to the Royal Society of London; but this plan has not been published, and the plan of the river contained in the general map of the isthmus does not give the soundings. The two lines for railroads by that engineer, extending from the junction of the Trinidad with the Chagres, the one to Panama, and the other (much shorter) to the bay of Chorrera, are marked on the published map; but the series of levellings in this direction are not given. The country intersected by these lines is interspersed with savannahs, and presents along the banks of the Trinidad a wide vale of flat and swampy land, with occasional detached conical hills and small streams, most of which fall into the Chagres. The number of these streams to be crossed, which are swollen in the rainy season, would present a serious impediment to the construction of a permanent railroad, but would in the same degree favor that of a canal in this direction.

The government of the United States, under its different administrations since the independence of Spanish America, has never ceased to take a deep interest in the question of a canal communication between the two oceans. In the letter of instructions given in 1826 by Mr. Clay, then Secretary of State, to our plenipotentiaries appointed to attend the Congress of Panama, reference is had to a correspondence on this subject between him and the minister of Central America; and it was stated that, if the work should ever be executed so as to admit of the passage of sea vessels, the benefits of it ought not to be exclusively appropriated to any one nation, but should be extended to all parts of the globe, upon the payment of a just compensation or reasonable tolls. Our ministers were consequently directed to state to the ministers of the American powers, that the government of the United States took a lively in-

* Philosophical Tractactions, 1830, part 1, pp. 62, 63.

terest in the accomplishment of the work, and would attentively examine any proposals that might be made, or plans that might be suggested, for its joint execution, with an earnest desire to reconcile the interests and views of all the American nations.

In 1835 a resolution passed the Senate, by which the President of the United States was requested to consider the expediency of opening negotiations with the governments of other nations, and particularly with the governments of Central America and New Grenada, for the purpose of effectually protecting, by treaty stipulations with them, such individuals or companies as might undertake to open a communication between the Atlantic and the Pacific oceans, by the construction of a ship canal across the isthmus which connects North and South America; and of securing forever, by such stipulations, the free and equal right of navigating such canal to all nations, on the payment of such reasonable tolls as might be established to compensate the capitalists who might engage in such an undertaking and complete the work.

Under this resolution, President Jackson immediately appointed Colonel Charles Biddle as an agent to make the necessary preliminary observations and inquiries, both at the isthmus of Nicaragua and that of Panama, with reference to the opening a communication either by canals or railroads. This agent visited the latter only, and decided, on what appear to be very insufficient grounds, in favor of a railroad, as being preferable to a canal, as the means of accomplishing the desired purpose.

In the meantime, the Congress of New Grenada granted to an adventurer, named Baron Thierry, the privilege of opening a ship canal to unite the waters of the Chagres with those of the Rio Grande, which falls into the bay of Panama, by means of the small river Obispo, a branch of the Chagres. No measures were subsequently taken to execute this grant, which appears to have become obsolete.

In this state of things, the subject was again taken up in 1839 in the House of Representatives of the United States, on the memorial of the merchants of New York and Philadelphia, on which a very elaborate report was made by Mr. Mercer, from the Committee on Roads and Canals, accompanied with documents and maps illustrative of this important subject. The report concluded with proposing a resolution that the President "should be requested to consider the expediency of opening or continuing negotiations with the governments of other nations, and particularly with those the territorial jurisdiction of which comprehends the isthmus of Panama, and to which the United States have accredited ministers or agents, for the purpose of ascertaining the practicability of effecting a communication between the Atlantic and Pacific oceans, by the construction of a ship canal across the isthmus, and of securing forever, by suitable treaty stipulations, the free and equal right of navigating such canal to all nations." This resolution was agreed to by the House.

I am not informed what measures were taken by our government under this resolution, but it appears that the government of New

granada had already made, in the year 1838, a grant to a French house of trade, under the firm of Salomon, Talie and Company, of the privilege of constructing either Macadamized roads, or railroads, or canals, across the isthmus. It has also been since stated that the house in question had already constructed a road from the bay of Chorrera to the junction of the Rio Trinidad with the Rio Chagres; had formed an association with another house in England, and had ascertained, by actual levellings, the practicability of constructing a ship canal to connect the Rio Chagres with the Rio Grande, by a newly discovered route, on which the summit level does not exceed forty feet. This canal, it was stated, would require no locks, but would form, by an open cut, an artificial strait from sea to sea, of sufficient dimensions to admit the largest vessels. I confess myself at a loss to reconcile this statement, so far as respects the alleged results of the surveys made by the engineers employed by this association, with Baron Von Humboldt's letter to Mr. Salomon, dated August 1, 1842, an extract from which was read in the chamber of deputies by M. Guizot, of the 10th of June, 1843. In this letter, Humboldt refers to the advice he had formerly given to the British embassy at Paris, to cause a competent engineer to be sent from Jamaica to explore the isthmus with a view to ascertain the practicability of the new route in question, and expresses his regret that nothing had been done in consequence of this advice. "I am sorry to learn," says he, "that you are no further advanced in your interesting undertaking than you were when I had the pleasure to see you in my last visit to Paris. Five and twenty years have now elapsed since the project of a communication between the two oceans, either by the isthmus of Panama, the lake of Nicaragua, or the isthmus of Cupica, has been proposed and discussed topographically; but nothing towards realizing this project has yet even been commenced. I should have thought that the English embassy might have found the means of inspiring confidence by proposing to send a man of science (an engineer) in order to study the valley which separates the two seas, and along which the canal might be cut to the western part of the port of Chagres. Be persuaded that those persons who make use of the authority of my name to support the idea that the two seas are not on a level, only do so in order to excuse themselves from engaging in the undertaking."

Mr. Guizot also refers in his speech to a communication on this subject, made to the Academy of Sciences at Paris, by our countryman, Mr. Warden, who speaks of a ship canal to unite the small rivers which fall into the bay of Chorrera with the Atlantic by some route which is not explained, but which would require *the use of locks*. Mr. Warden has since informed me that he referred to the route said to have been explored by the French commercial house above mentioned. Mr. Guizot draws no other conclusion from these different statements than the very reasonable one as to the possibility, and even probability, of the project of a ship canal at the isthmus of Panama being realized; from which he very justly infers the most important consequences as inevitably to result in

respect to the commercial relations between Europe and Asia. At the same time, the French minister cautiously abstains from expressing an opinion as to the manner of proceeding, in order to accomplish a design so important to the French, English, and Dutch insular possessions in the Pacific ocean. He only admonishes the chamber of the necessity that France should not remain an indifferent spectator at a moment when Great Britain had already taken a position in Central America upon all the points where the passage might be cut—in the gulf of Honduras, on the Mosquito shore, and more recently at the Isle of Moatan; not that she ought to appropriate solely to herself the undertaking, but in order to be the first to profit by it, and to derive from it the greatest possible advantages. This admonition applies with equal force to the United States, who have still greater interests at stake in the question than France, and indeed than any other nation. The fair conclusion seems to be that it can only be satisfactorily settled by the cordial co-operation of the three great maritime powers.

Such was the state of our knowledge respecting the passage of the isthmus of Panama, when the French government resolved to send a competent engineer to explore this route, and to determine the practicability of constructing a ship canal between the two seas. M. Garella, a distinguished engineer, who had been previously employed in similar operations in the Pyrennees, was selected for this service, and furnished with all the necessary aids for the accomplishment of the important objects of his mission. The official report of M. Garella, containing the results of his observations, was communicated to M. Guizot, minister of foreign affairs, in the month of May last, and though it has not yet been published in extenso, the substance of its contents is sufficiently known to enable us to determine how far they correspond with the expectations formed by the public from a mission so honorable to the enlightened government by which it was instituted.

One of the most important objects to which the attention of M. Garella had been directed by his instructions, was to a certain how far the cordillera of the Andes, which has been supposed to run in an uninterrupted chain throughout the two American continents, from Cape Horn to the Arctic ocean, is in fact broken off, or declines and disappears at any point of the isthmus connecting the two continents. The trigonometrical observations of the French engineers, which appear to have been made with great care and accuracy, result in demonstrating that, in the country lying between Porto Bello and Panama, a considerable depression occurs in the cordillera, the lowest point of which is from 120 to 160 metres above the level of the sea. In other parts it continues to rise from ten to twenty times higher. M. Garella, therefore, concludes that the summit level to be overcome would not present an insurmountable obstacle to the construction of a canal of ordinary dimensions, such as those which have been carried over the same elevation both in Europe and in America. But the problem to be resolved was the construction of a ship canal between the two seas, three times as long and four times as deep as the canals called in France *d*

grande section, with the aid of locks on a scale of similar proportion.

To feed a canal, of whatever dimensions, water is necessary; and the next object to which the inquiries of M. Garella were directed, was to ascertain the means of supplying with water a canal of such vast dimensions. For this purpose he gauged the river Chagres, the only source of supply, and ascertained that by means of two lateral canals (*rigoles*) the necessary supply of water might be obtained. But in order to make this source of water available for the use of the canal, it is indispensably necessary that the summit level between the two seas should be brought much lower than the present surface of the land at its lowest point of depression. Instead of 120 or 160 metres of elevation, it must be reduced to 50 or 60 metres. Should the summit level remain at the former elevation, it is evident that the number of locks necessary to overcome it would be multiplied to such a degree as to render the navigation with large vessels very difficult, if not quite impossible. In order to meet this difficulty, a choice must be made between two means which present themselves. These are, a deep cut and a tunnel. It is believed that no example exists of such a cut being effected in solid rock, and M. Garella therefore gives the preference to the other alternative of a tunnel. He was not deterred by the unexampled magnitude of this tunnel, far transcending any similar work of the Etruscan kings of Rome, or which the more perfect science of the modern engineer has hitherto accomplished. The vault of a tunnel to be traversed by an oceanic canal, bearing ships of 1,200 tons, must be at least thirty metres above the level of the water. The idea of such a tunnel has been hitherto rejected by all those who have studied the question; but the engineer employed by the French government, after a careful examination of the geological features of the country, does not hesitate to pronounce its execution to be practicable, at an expense of not exceeding forty-four millions of francs. The passage between the mountains (*le col*) through which he deems it expedient to direct the canal, is that of Abogayegua, at the height of 140 metres above low water mark. The level which he adopts for the summit level would be forty-one metres above the sea, and consequently ninety-nine metres above the surface of the ground. In order to gain this level for the basin between the two divisions of the canal, the tunnel must be extended to the length of 5,350 metres. It would then require *only* eighteen locks on one side, and sixteen on the other, whilst an ample supply of water would be thus secured.

It is not without great diffidence that I venture to express doubts respecting the practicability and utility, for the purposes of ship navigation, of constructing at this place a tunnel 5,350 metres in length, 20 metres in width, with a height of 30 metres above the water line, and 37 metres from the bottom of the canal. The tunnels hitherto constructed to facilitate the passage of ordinary canals and railroads have not usually exceeded 8 metres in breadth, and height, which represents a section of tunnelling 12 times less than that proposed by this distinguished engineer. Until, there-

fore, the Academy of Sciences, or the general council of the *Ponts et Chaussees*, to whom it is supposed that the French government will have referred the question, shall have pronounced their judgment upon it, we may at least venture to keep our minds in suspense respecting it.

On the supposition that his proposed tunnel should be rejected by the competent judges, M. Garella again recurs to the other alternative of a deep cut. But, on account of the configuration of the soil, he does not propose to give to this cut the depth necessary to bring it down to a level with the projected tunnel. He stops at a line 15 metres higher, by which the cut would be 84 metres deep; which is also believed to be without example, but the practicability of which is left to the better judgment of the competent technical authorities. It is only necessary to observe that this proposition would require the addition of five more locks on each side, and that these must be *ecluses accolees;* that is, locks touching each other, and consequently would be still more unfavorable to ship navigation. The length of the cut would be more than six kilometres. The expense would be somewhat less than that of the tunnel. To excavate the cut so low as to bring it down to a level with the projected tunnel, and consequently 99 metres deep, would require an expense of thirty-five millions more than the tunnel.

The report of M. Garella further proposes to use the course of the river Chagres in order to complete the canal communication towards the Caribbean sea, deepening and enlarging its channel where required, and thus to enter the sea at the bay of Limon, which would, however, require the construction of a pier to protect the shipping against certain winds. On the side of the Pacific ocean, it is believed to be impossible to terminate the canal at Panama; but M. Garella states that he found at *Vaca de Monte*, 18 kilometres to the west of Panama, a safe roadstead where the canal might be terminated on that side.* The whole passage from sea to sea would thus be 76 kilometres, of which 55 by the canal from the Pacific ocean to the Rio Chagres, 9 on the Rio Chagres, and twelve between the Chagres and the bay of Limon. Materials of construction are abundant in the vicinity, such as timber, stone, lime, and clay, for the making of bricks. The whole expense, including the tunnel and the works necessary to improve the ports at the two outlets, is estimated at one hundred and thirty millions of francs.

In order fully to understand the description of the two last possible communications between the two oceans enumerated by Humboldt, it is necessary to state that the great cordillera of the Andes, as it approaches the isthmus which unites the two American continents, divides itself, under the second degree of north latitude, at the knot of mountains which contain the sources of the Rio Mag-

*It is not probable that the place should be named *Vaca de Monte*, but I do not find on the map *Boca de Monte*. It is true that all our maps of the isthmus are very defective, as is proved by the enormous error pointed out by Mr. Banza, in the bay of Mandingo, which goes deeper into the land, and renders the isthmus narrower at this point than has been heretofore supposed.

dalena, into three separate mountain chains. The first of these stretches to the northeast between the lake of Maracaibo and the city of Valencia, and unites with the cordillera running along the coast of Venezuela. The second or middle chain (that of Panama, Guanacas, and Quindia) divides the valley of the Rio Cauca from that of the Magdalena, extends itself in a northern direction, and fastens itself in the province of Antioquia on to the most western chain of New Grenada, which gradually sinks down and disappears between the left bank of the Rio Atrato and the coast of the Pacific. In this ridge is included the highest peak of the Andes north of the equator, that of Tolima, which is 17,200 feet above the level of the sea. The third or western chain is that of Choco, on the west side of the Rio Cauca, which approaches so near to the second as to leave only a narrow rocky bed for the escape of this river to the sea. From its declivities flow the Rio Atrato (also called the Rio Grande del Darien, Rio Dabeiba, and Rio del Choco) northward into the Gulf of Darien, and the Rio Noanama (commonly called the San Juan) south into the Pacific ocean. As the mountains approach the isthmus of Darien, they gradually sink down towards the coast of the Pacific into a level plain. The mountains of the isthmus of Panama may, by their directions and geographical position, be considered as a continuation of the mountains of Antioquia and Choco; but there is hardly a single ridge or elevation to be found in the plains to the west of the lower Atrato.*

4. The fourth possible communication, then, is by the isthmus of Darien. To the southwest of Panama, following the coasts of the Pacific ocean, lie the bay and port of Cupica. At the time when Humboldt wrote, the geographical position of Cupica was very uncertain; but Berghaus has since shown, by the analysis of various astronomical observations, that it lies in seven degrees fifteen minutes north latitude, and eighty degrees six minutes and three seconds west longitude from Paris.† From Cupica the traveller passes over a flat country (*terreno enteramente llano*) very proper for the excavation of a canal, which, at the distance of five or six leagues, would unite with the river Naipi, or Naipepi, which joins, near the village of Zitara, the great river Atrato, which flows into the gulf of Darien. The navigation of the Naipi is impeded by cataracts and rapids, which, according to Captain Cochrane, would require a lateral canal to avoid them.‡ The great chain of the Andes, according to this traveller, is here entirely broken off, and sinks first into hills, and then into a level plain between the bay of Cupica and the mouth of the Atrato. But it would require a much more accurate knowledge of the country than we at present possess, to determine the practicability of constructing a ship canal in this direction.

5. The fifth and last of these communications which might possibly be effected, is that which would pass through the transversal

*Humboldt, Essai Politique, tome I., pp. 232, and 234.
†Annalen, 3te reihe, 5 bd., s. 501.
‡Cochrane's Travels in Colombia, vol. II. p. 443.

valley formed by the two rivers, Atrato and San Juan. I am wrong in saying possibly, since a communication by water between the two oceans already exists in this direction. In the year 1788, the curate of the village of Novida caused to be dug, by the labor of the Indians, his parishioners, the little canal of Raspadura, in the ravine of that name, which is often filled by the natural inundation of the neighboring waters. This canal conducts into the small river Onibdo, which, after being joined by several other streams, forms the Atrato, which falls into the gulf of Darien, whilst the Rio Neonama, or San Juan, empties into the Pacific ocean. The two seas are thus already joined together, by a combined natural and artificial communication between two points, distant from each other about seventy-five French leagues. This canal, in its present state, is only navigable for small boats, but might doubtless be enlarged in a country where there is such an abundant supply of water from the constant rains which prevail throughout the year.*

It is very much to be regretted that the observations of M. Gazella, above noticed, should have been confined within the narrowest part of the isthmus of Panama, between Porto Bello and the town of Panama. The illustrious philosopher to whom we are so much indebted for our knowledge of the geography of the American continent, has not ceased, during the forty years which have elapsed since his return from the new world, to call the public attention to the importance of constructing a ship canal through some part of the isthmus, and it is not his fault if the recent explorations have not been made in the right direction so as to secure a satisfactory result. During the frequent conferences which I have had with my venerable friend on this subject, he has always insisted on the necessity of extending the observations to the east and southeast of the line from Porto Bello to Panama, throughout that part of the neck of land which joins on to the continent of South America, and especially where it is narrowed by the gulf of Bandinga, called also the gulf of San Blas. He holds it to be quite certain that, between the bay of Cupica and the branches of the Rio Atlanto, the cordillera of New Grenada entirely disappears. Captain Cochrane, who passed from sea to sea by this route, found only three ranges of little hills. This disappearance of the cordillera renders it geologically probable that, between the gulf of Bandinga and the gulf of San Miguel, the crest which forms the highest point rapidly sinks down, first into hills, and then into a level plain (*terreno enteramente llano.*) This part of the country has never been examined with a view to the construction of a canal. What Baron Humboldt then proposes is, that it should be thoroughly explored by three or four persons, such as might easily be found in the United States, who have been accustomed to such operations. Here will probably be found the true "secret of a strait" which Columbus and Cortes vainly sought to discover.

The reasons for preferring a ship canal to one which would require a transhipment of the cargoes of the vessels navigating such

* Humboldt, Essai Politique, tome I., p. 235.

ocean, or to a railroad which would require the goods to be landed and stored, in order to their transportation across the isthmus, cannot be better stated than in the following words of a recent English traveller: "Another consideration, in my opinion, is also indispensable to the success and utility of this undertaking, viz: that the canal should be made of a capacity sufficient to admit merchant vessels to pass through without discharging their cargoes. To make a canal for boats, or on any other scale than to permit vessels to pass on to the ulterior destination of the goods, would be entirely nugatory. The expense and delay of transporting the cargoes by boats in such a country as that through which the canal passes would be very great, and the loss by periodical rains, robbery by an irregulated population, and a thousand causes, would counterbalance all other advantages; but the principal difficulty and expense would be to procure vessels in the Pacific to prosecute the remaining part of the voyage. On this ocean, at present, the freights paid for vessels are most exhorbitant; and from the nature of the coasts in the neighborhood of the canal, which are all unhealthy, and unfit for the creation or maintenance of a marine, no improvement of consequence is to be expected. It would result in the case supposed, of a mere boat canal—that, after a cargo had been forwarded to the eastern entrance of the canal and transmitted to the Pacific by boats, the time that might elapse before a vessel could be procured to proceed with this cargo to China, or other destination, would be more, and the expense greater, than if the original vessel had proceeded directly round the Cape of Good Hope. It has been lately much recommended to make a railroad from Porto Bello to Panama, or somewhere in that vicinity; but the foregoing objections apply with as much force to this project as to a canal for boats, and I should consider such an undertaking utterly useless in a commercial point of view. If, on the contrary, the canal was made capable of admitting vessels to pass through with their cargoes, the delay would be very small, and the expense trifling. Asia would be thereby brought, by one half, nearer to Europe, and the passage to all the west coast of America and the Pacific islands shortened in a still greater degree. This revolution in the commerce with Asia and the Pacific ocean, if it were to happen, would aggrandize the country of which we have been treating (California) in an extraordinary manner; and, however distant this era may be, it is not to be supposed that in the present state of the world, when such rapid progress is making in everything that is useful, this gigantic improvement will be indefinitely delayed; and particularly when it would appear that the means are but trifling in comparison to the end proposed."*

Without pretending to enter into the various technical questions which belong to the subject, it may be affirmed that experience has already demonstrated, in several instances, the practicability of constructing a ship canal, such as would be sufficient to accomplish the junction of the two oceans, either at the isthmus of Nicaragua, or that of Panama.

*Forbes, History of California, p. 319.

1. The first example of the kind which may be noticed is that of the Caledonian canal, in the north of Scotland. This canal stretches across the island, from northeast to southwest, from a point near Inverness, on the Murray frith, to another near Fort William, on the western coast, opposite to the isle of Mull. It was constructed by excavations of twenty-one and a half miles in extent, and a lockage of 190 feet, connecting a succession of fresh water lakes, the beds and outlets of which were deepened to correspond with the intervening canals. The total length of the canal, including the lakes, is 58½ miles. It is 20 feet deep, 50 feet wide at the bottom, and 122 at the top. The locks are 20 feet deep, 172 long, and 40 broad. Frigates of thirty-two guns, and merchant ships of one thousand tons, pass through it. The canal was constructed at the expense of government, and cost £986,924 sterling. Baron Von Humboldt has noticed the striking analogy which exists between the localities of this stupendous work and those of the isthmus of Nicaragua. The breadth of the isthmus is about the same with that traversed by the Caledonian canal. The position of the lake of Nicaragua, and the natural outlet of this lake into the Caribbean sea, present several traits of resemblance with that gorge of the Scottish highlands where the river Ness forms a natural communication between the mountain locks and the frith of Murray. At Nicaragua, as in the highlands of Scotland, there is only a single isthmus of earth to be cut through; for if the Rio San Juan is from thirty to forty feet deep, as is stated, it will only be necessary to canalize it partially by embankments or lateral cuts.*

2. But the most stupendous work of this kind in Europe, and, perhaps, in the world, is the ship canal from Amsterdam, in Holland, to Niewdiep, near the Helder, which I have had an opportunity of examining. This canal was constructed by the Dutch government to avoid the inconveniences attending the ordinary navigation from the port of Amsterdam to the German ocean, by the Zuyder Zee, which abounds in sand banks and shallows. The length of the canal is 50½ miles; the breadth at the surface of the water is 124½ feet, the breadth at the bottom 36 feet, and the depth 20 feet 9 inches. Like the Dutch canals generally, its level is that of the highest tides, and it receives its supply of water from the sea. Of course, the only locks it requires are two tide-locks at the two ends; but there are besides two sluices with floodgates in the intermediate space. The locks and sluices are double; that is, there are two in the breadth of the canal. There is a broad towing path on each side, and the canal is wide enough to admit of one frigate passing another. The whole work cost twelve millions of guilders; being something more than the expense of the Caledonian canal, which it far exceeds in the volume of water it contains. But it should be added that, on account of the evenness of the ground it passes through, the difficulties encountered by the engineer were trifling in comparison with those which have been overcome in the highlands of Scotland.

* Humboldt, Voyage, &c., tome IX., p. 362.

The example of these great hydraulic works shows what may be accomplished by scientific skill in overcoming the obstacles interposed by nature to such artificial communications. The difficulties to be surmounted in the construction of a ship canal across any part of the isthmus which connects the two continents, physical, political, and moral, are doubtless great; but to an enterprising people, like that of the United States, which has already achieved works of a similar nature on such a gigantic scale, these difficulties will not appear insurmountable. The obstacles presented by the climate, by the indolence and inertness of the present inhabitants of these regions, by the unsettled state of the local governments, and the consequent want of security for property and contracts, all these are doubtless to be taken into consideration in estimating the difficulties and the expense of such an enterprise. Great allowances must also be made for the exaggerations of interested companies or individuals who may propose to undertake the work; and for the involuntary errors of engineers, who, however skilled in the science of their profession, are often led by the fond enthusiasm of genius to imagine magnificent plans, without sufficiently estimating the practical difficulties which must be encountered in their execution. It must always be remembered that every project of a canal communication between the two oceans, which requires a great number of locks, although it might be sufficient for small vessels, such as are usually employed in the coasting trade, would never be adequate for the convenient passage of large ships, such as are employed in oceanic navigation. This consideration seems to form a decisive objection to the plans presented by Don Gaëtan Moro for the construction of a ship canal through the isthmus of Tehuantepec, and by M. Garella for a similar work through the isthmus of Panama. But it can never be sufficiently repeated that the possibility of executing a work adequate for the convenient passage of the largest ships ought not to be abandoned until the passage by the lake of Nicaragua shall have been more thoroughly investigated, and the entire region extending east and southeast of the line between Porto Bello and Panama, quite to the bay of Cupica and the gulf of Darien, with the intermediate waters, shall have been explored by competent persons. It is believed that it would be worthy of the government of the United States to take the initiative in these explorations, on the result of which the success of the whole design in question must ultimately depend. It has already been shown that we have more important interests, political and commercial, involved in the matter than any other nation; but, like all other international questions, it can only be satisfactorily adjusted by concert with the other maritime powers which have similar interests, more or less important, and whose assent is necessary to place the proposed passage under the protection and guarantee of the public law recognised by the whole world.

In closing this despatch, which has already extended to an unusual length, if any apology be necessary for what may perhaps

be deemed a deviation from the sphere of ordinary diplomatic duties, in presenting this important subject in its various bearings to the consideration of the department, I trust that apology will be found in the zeal of a public servant anxious to promote, by every means in his power, the honor and interests of his country.

I have the honor to be, with the highest consideration, sir, your obedient servant,

HENRY WHEATON.

The Hon. JAMES BUCHANAN,
Secretary of State of the United States.

Mr. Wheaton to Mr. Buchanan.

[No. 279.] BERLIN, *December* 24, 1845.

SIR: Since my last despatch (No. 278) was written and sent off, I have been favored by Baron Von Humboldt with the enclosed printed plan for the establishment of a railroad across the isthmus of Panama, by MM. Salomon & Co., which also contains some further information respecting the results of the surveys made by M. Garella, by order of the French government, with a view to the construction of a ship canal in the same direction.

I have the honor to be, with the highest consideration, sir, your obedient servant,

HENRY WHEATON.

The Hon. JAMES BUCHANAN,
Secretary of State.

NOTES RESPECTING THE ISTHMUS OF PANAMA.

By J. A. Lloyd, Esq.

[In November, 1827, Mr. Lloyd, who had served for some time previously on General Bolivar's personal staff, received from him a special commission to survey the isthmus of Panama, in order to ascertain the most eligible line of communication across it, whether by road or canal. And the result of his operations, in so far as they regarded the level of the respective seas, and the elevation of the intervening isthmus, has been already published in the Philosophical Transactions for 1830, p. 59. The following supplementary information seems, however, still interesting, and it is extracted from Mr. Lloyd's entire notes, communicated by him to the Royal Geographical Society, before his recent departure for the Mauritius.

His occupations while at home having put it out of his power to revise his materials, it has been thought expedient to change their form from the first to the third person, the more distinctly to relieve him from the responsibility of their selection and arrangement. But where possible, his own words have been preserved.]

The isthmus of Panama, or Darien, may be considered as extending from the meridian of 77° to that of 81° west of Greenwich; with a breadth swelling out at the two extremities and not less than 30 miles, even where narrowest, opposite the city of Panama. Its whole extent is not, however, comprised within the Spanish American province, the Mandingo Indians to the northeast maintaining a fierce and often turbulent independence to the present day.

1. *Physical Geography.*

The cordillera, or great chain of mountains, which for the most part traverses the whole continent of America, is twice broken within the above limits.

The northern cordillera exhibits the first indications of depression in the Nicaragua, but again rears itself, for a time, in the province of Veragua, and is there crowned with a very fine plain called La Mesa (The Table.) In the eastern part of the province it breaks into detached mountains of considerable height, and of the most abrupt and rugged formation; thence, proceeding still to the eastward, innumerable sugar-loaf mountains appear, not above three or four hundred feet high, with their bases surrounded by plains and savannahs; and, finally, about Chagres on the one side, and Chorrera on the other, these also disappear for a few miles, and the country becomes almost uninterruptedly low and flat. Presently, however the sugar-loaf mountains again thicken, and becoming connected, form a small cordillera, running from about opposite

Porto Bello to the bay of Mandingo, where is the second break. The land then continues low through the province of Darien and Choco and is most abundant in rivers, those on the north side tending to the Gulf of Uraba or Darien, and those on the south to that of St. Miguel; beyond which point the cordillera again raises itself on an extended scale and enters South America.

The general direction of the mountains in the vicinity of Panama is northeast and southwest; elsewhere, they vary, maintaining some relation to the line of coast, though not always parallel to it.

Near Panama, they do not exceed one thousand or eleven hundred feet in height; east of Porto Bello, they are greatly higher, and are generally covered with thick and almost impenetrable wood, growing on an extraordinarily fruitful soil of great depth.

The prevailing rock is limestone, skirted on the north side with coral rocks, and on the south with indurated clay. The coral rock is impregnated with a gelatinous matter, which gives it the property of adhering with great firmness to whatever, under water, it is placed against. It is close in its texture, and becomes very hard on long exposure to the air; but when first dug out is not more difficult to work than chalk. The indurated claystone, along the Panama shore, is also an excellent building material, becoming, though soft at first, hard on exposure. For facility of working, it is generally obtained, where softest, below high-water mark.

Besides limestone, are found, in the interior, flint, chalcedony, jasper, ironstone, and near Gatun, on the river Chagres, a very fine firestone, of great use in the construction of kilns, furnaces, &c. Clay and loam earth for bricks are also abundant, and sand to mix with lime in mortar. "In a word," says Mr. Lloyd, "perhaps no part of the world possesses a greater variety of building materials, nor more facility in procuring them, than does the isthmus of Panama." In the precious metals, however, the province is poor. In Panama proper only two mines are worked, Santa Rita and Pequeni, both for gold, but their produce is insignificant. They are in the mountains near Porto Bello. In the Veragua, including Choco, a considerably quantity of gold is obtained by washing, and is reckoned very pure; copper and iron are abundant, and tin and mercury are said to have been found. But very little capital is embarked in the respective works; and the washings, in particular, are chiefly in the hands either of a few proprietors of slaves who thus employ them, or of free Indians who select what they consider favorable situations, occupy them without paying any rent or acknowledgment, employ one portion of the year in collecting the alluvium from the bottom of the rivers, and piling it up in heaps, a second in washing it, and the remainder in selling the produce, and wasting it in finery and excess. The total amount is thus comparatively small, and uncertain from year to year.

The vegetable productions of the isthmus are most luxuriant, and in the vigor and varieties of its woods, it challenges competition, in Mr. Lloyd's opinion, with any other part of the world. The following is the list found among his notes, and he has also

deposited with the society a collection of specimens of the respective woods:

1. *Amarillo.*—A yellow wood; hard, tough, fine grained, and very durable; has no heart; is in great quantities, used for furniture, house building, &c. *Excellent.*

2. *Amarillo de fruta.*—Bearing a fruit; is yellowish white, with a long grain; tough, and rather hard; is very common; grows to the size of not more than two feet diameter; the heart is of the same color; is much used in house building.

3. *Amarillo carbonero.*—A white brown wood, with large heart, close grained, and hard; is very tough, and grows to the size of one foot or one foot and six inches diameter; is used for houses and buildings; not very common.

4. *Amarillo colorado.*—

5. *Amarillo curabasuel.*—A green wood; hard and brittle; grows to a very large size, and is common; used for building, and making very large tables.

6. *Almacigo.*—White; something like white deal; soft, not tough; three feet diameter; very common. There is a resin comes from this tree when pierced, much used in the country for sores; has a very thick bark.

7. *Alcabow.*—Brownish, coarse, shiny grain; grows from six inches to two feet diameter, and common; has no heart; good for staves.

8. *Algarobo.*—One of the most excellent woods known; very hard and tough; reddish brown, with streaks; grows to a large size, and common; used for marine gun carriages, &c.; called in Jamaica, *mogo.*

9. *Aguacate.*—Whiteish; coarse grained, hard, and tough; common; grows to the size of two feet.

10. *Ajisillo.*—

11. *Aromo.*—A soft, long grained, shiny, whitish wood; very light and tough; grows to a good size, and common.

12. *Algodon.*—Cotton tree; white, spongy, light, close grained, and brittle; very common.

13. *Balsa.*—Literally, "raft;" light, and very soft; the lightest of all woods—as light nearly as cork; used as rafts, and for polishing metals; grows to not more than one foot diameter.

14. *Cocobolo amarillo.*—Like rose-wood; very tough and hard; seldom grows to more than one foot diameter, but occasionally larger; has a fragrant smell, with dark brown streaks—I think something like zebra wood; is very common in the high dry lands.

15. *Cocobolo prieto.*—A very tough, hard wood, of a beautiful figured grain; (I think like rosewood;) grows to the size of about three feet diameter, but generally smaller; is very plentiful; has a very fragrant smell when green; used more for carpentry than cabinet work.

16. *Cacique, or king of woods.*—One of the finest and most durable woods of South America; whitish yellow; hard, tough, and

long grained; grows to a large size; is common, and much used for building in the ground or water.

17. *Conejo.*—Hard, fine grained, same as boxwood; grows to a small size, and is scarce.

18. *Conejo colorado.*—Yellowish; very close, fine grain, like holly, but harder; grows to a good size.

19. *Cedro cevollo.*—A class nearly the same as cedro real.

20. *Cedro espinoso, or prickly cedar.*—Grows to an immense size, but not quite so much prized by the natives as cedro real; has a long spotted grain; is softish, brittle, and covered with prickles on the outside.

21. *Cedro papallo.*—One of the many species of cedar.

22. *Cedro real amargo.*—The finest cedar of the country; of a strong fragrant smell, and long grain; used for many purposes in carpentry and boat and canoe building; grows to five or six feet diameter, and is very common.

23. *Caoba.*—Bastard mahogany; not very common in the vicinity of Panama, but brought in immense quantities in canoes from the coast, where it is very abundant, and grows to an immense size.

24. *Corotu.*—Like elm; grows to a large size; used for canoes.

25. *Corotu prieto.*—Soft and porous, like walnut; long grained; grows to an enormous size; is generally used next in preference to cedar for the largest bongs and canoes, and is very abundant in all parts.

26. *Cereño.*—Close grained, like holly; light brownish yellow; tough; grows to a small size, and is common; is most excellent for scales.

27. *Carati.*—Hard, close grain; brownish, tough, heavy; grows to the size of one foot six inches diameter, and is very common.

28. *Calmitillo.*—Like birch; grows to about one foot six inches diameter, and is very common.

29. *Ciruello.*—Very white, long grain, soft, spongy, not tough, small size, scarce; the bark used medicinally, as an astringent.

30. *Ciromo.*—

31. *Ciquarri.*—A fine wood; hardish and tough; something like bastard mahogany, but a more shiny grain.

32. *Espino di mata.*—Like birch; dirty white, long grained, soft, not tough; grows to small size, and is scarce.

33. *Espino colorado.*—Like walnut tree; a dark wood, nearly the color of cedar, but much harder, and a close grain; grows to about three feet diameter; beautiful wood for boat building.

34. *Espabé mulato.*—A softish, long grained, close, tough, very knotty and refractory wood, but very lasting; grows to an immense size, and used universally for flooring and wainscoting; is very common.

35. *Espabé prieto.*—One of the common woods of the country; I think something like elm; grows to the size of five feet diameter, and is used in every branch of house building; it has rather a rough grain to work.

36. *Frijollillo.*—Soft grain.

37. *Faultin.*—Like birch.

38. *Guallacan.*—Lignum vitæ; very common, close grained, hard, heavy, and tough; works exceedingly well when rather green; grows to the size of from four to five feet diameter, and is much used for gun-carriages, wheels, &c.

39. *Guachapali.*—Soft, open grain, like walnut; brownish, tough, and rather heavy; grows to four or five feet diameter; is much used for canoes and house building.

40. *Guayavito aseyjan.*—White; a beautiful close grain; hard, tough, and heavy; grows to a small size, and is a very common wood.

41. *Guava machete.*—Like birch; so called from bearing a fruit like, in shape, to a bill hook or machete; brownish white, long coarse grain, and middling tough; grows to but a small size, and is not common.

42. *Guavano.*—

43. *Gallito.*—Soft, long, open grain; whitish yellow, light, and porous; grows to the size of one foot six inches diameter, and is common.

44. *Guallavo armigero.*—So called because much infested by ants; it is of a whitish yellow color, soft, rather tough, of a long open grain and lightish; grows to about two feet diameter, and is common.

45. *Guanavano.*—A whitish yellow, light wood, is not very tough; grows generally in swampy grounds, to the size of two feet diameter, and is scarce.

46. *Guavito.*—A very white, soft wood, of an extremely bitter taste, and used as a medicine against the bite of serpents; grows to the size of from four to six inches diameter, is common, but has no other use than as a medicine.

47. *Gorgojo blanco.*—A very white, long grained, soft wood, but close; grows to the size of from one to two feet diameter; rather brittle, but plentiful.

48. *Guarumo.*—

49. *Guava peludo.*—Fruit tree, covered with a hair-like substance; yellowish white, long grained, tough, and soft; grows to two feet diameter, and is common.

50. *Huerito, or little bone.*—Hard, close grain, like bone: is much used for any small articles of ornamental cabinet work, and handles to tools: grows but to a small size, and is not common.

51. *Jagua colorada.*—Soft, close grained, but tough: grows to about one foot six inches diameter: is a dye wood, and much used by Indians to carve into spoons, or small articles of ornament.

52. *Jagua.*—Whitish brown: long, open grain: soft, but tough: grows to three feet diameter, and is common.

53. *Jobo de lagarto.*—A hard, close grain, like beech: the bark like the skin of an aligator: whitish, long grained, and close: soft, grows to a large size, and is common.

54. *Joboliso.*—Close grained, spongy, flesh white, soft, brittle, and light: grows to a small size, and is common.

55. *Igeron.*—Like ash: one of the most plentiful woods in the country, along the banks of the rivers: a soft, whitish wood.

56. *Jassimo.*—Hard grained.

57. *Jassimo prieto.*—Yellowish white, or brown: soft, brittle, coarse grained, and spongy: grows only to a small size, and is common.

58. *Limon.*—A fine grained, shiny, whitish wood: hard and tough, something like ash: bears the lime, or small lemon of the country: is a native of dry ground, and grows to but a small size.

59. *Laurel.*—A coarse, brownish, white wood: tough, long grained, and soft: has a small heart: grows to about two feet diameter, and is used for building common houses.

60. *Laureño.*—Soft: a dirty white color: coarse grained, brittle, and light: is common, and grows to a small size.

61. *Moro*—(fustic.)—Yellow, with a long fine grain; hard and tough; grows to the size of three feet six inches diameter; a fine dye; very common in the woods on the banks of the river Chagres; has a peculiar smell.

62. *Mamaisillo.*—A close grain: grows from six inches to one foot diameter: the grain something like birch, but very tough, and yellowish, reddish, and red brown: is much used for rafters, and is common.

63. *Mangle*—(mangrove?)—Close grain, like birch; reddish brown, and very hard; is much used as timber for vessels; is very common throughout the low and swampy lands near the coast.

64. *Madroño a la sano.*—Like lime tree: yellowish white: of a beautiful close grain: hard, tough, and heavy: grows to one foot four inches diameter: is common, and used for uprights in house building.

65. *Madroño fino.*—Like box: an excellent wood for turning: grows to the size of one foot six inches diameter, and is common.

66. *Membrillo.*—White and tough, close grained, and lightish: and grows to a small size, and is common.

67. *Mata palo.*—So called from its killing any other tree that it grows near; a long, close, soft, shiny, grain; white, tough, and very common; grows to a large size.

68. *Mamey.*—Like cherry tree; a fruit tree of the country: a hard, close grain; grows to about two feet diameter, and is tough: not very common.

69. *Malegeto.*—Like ash.

70. *Maria.*—Grows exceedingly straight, and useful for masts and yards: white: long, close grain: soft and light: grows to one foot six inches diameter.

71. *Majaguillo.*—

72. *Majagua.*—

73. *Nispero.*—Hard, close grain; yellowish white, tough, and light; grows to about two feet diameter; is common, and used for house building.

74. *Naranjito.*—Like birch: a very tough, close grained wood, of a lightish brown: only grows to a small size.

75. *Naranjo del monte.*—Like box: a very fine, yellowish, close grained wood: very tough, and rather hard: grows to the size of

from six inches to one foot diameter: is particularly used for planes, tools, and axe handles, but is not very plentiful.

76. *Niema de huevo.*—A very tough, yellow wood, with a long, coarse grain: grows to about a foot or fourteen inches diameter; there is a considerable quantity of this wood, but no particular use is made of it.

77. *Negrito.*—Whitish, soft, and brittle: long spotted grain: grows to the size of about one foot six inches diameter, and is common.

78. *Olivo.*—Whitish, hard, tough, close grain, and heavy: grows to three feet diameter, and is common: the same as bird lime tree.

79. *Paiquillo.*—White, close grained, hard, not tough, and heavy: grows to a small size, and is scarce.

80. *Pilon.*—A reddish brown, close grained, hard wood: very tough and smooth: grows to two feet diameter, and is common.

81. *Pironel.*—Soft.

82. *Pali monton.*—A whitish close grained, hardish wood: rather tough: grows from six inches to one foot diameter, and is rather scarce: is generally used in house building.

83. *Palo blanco.*—A white, shiny, long grained wood: light, and soft, with a very small pith: grows to one foot diameter: is common.

84. *Quajado.*—Hard, close, very tough, and untractable grain; a most excellent wood; grows to the size of two feet diameter; indestructible; common, and much used in house building.

85. *Quira.*—A tough wood; very hard, close grained, and heavy; of different colors, from light brown to very dark; has an agreeable odor when newly cut; grows to the size of three feet six inches diameter, (but generally from one foot to two feet six inches,) and very high; it is plentiful, and much used in house building.

86. *Roble.*—Whitish gray, and long grained, like deal; grows to a large size, and very common; much used in house building, but particularly by the Indians for paddles for their canoes.

87. *Sigua amarillo.*—A yellowish wood: softish, fine grained, brittle, and light: grows to the size of one foot, or one foot six inches diameter: is very straight, and not scarce.

88. *Sota cavallo.*—Hard, close grain: a whitish, stringy wood: excellent for hoops: long grained, and tough: grows to a small size, but common.

89. *Sereso.*—Like beech.

90. *Siti.*—A hard, close, long grained, dirty, brownish white wood: tough, and grows to a large size.

91. *Sapo.*—A whitish, soft wood, little prized.

92. *Sangrillo.*—White, long grain, and soft: common, and grows from four inches to one foot diameter.

93. *Totuma.*—The calabash tree: a common wood: grows to the size of one foot diameter, or more.

94. *Torète.*—Yellowish white, soft, tough, long grain, and light: grows to about one foot two inches diameter, and is common.

95. *Vela.*—Has a fruit of a long, white, candle-like pod: the

wood is hardish, with a white, tough, and fine long grain: close and heavy: grows only to a small size, and is common.

96. *Ubero de montaña.*—Whitish, hardish, tough, and fine, spotted, long grain: grows to a small size, and scarce.

97. *Vella armadillo.*—A beautiful close grained wood, almost like box, of a lightish brown color: grows only to a small size—at most one foot diameter.

The fruits and esculent vegetables found in the isthmus are those of other similar intra-tropical situations. The grains cultivated are rice and Indian corn. The sugar cane is grown, but not extensively. Coffee and cocoa are cultivated, as required for domestic consumption. The caoutchouc tree,* milk tree, (*palo di vacca,*) and vanilla plant are all abundant in the woods. The charcoal made from many of the trees is considered excellent for smelting; and as such is exported to Peru, and in much request there. Some of them yield very rich and brilliant dyes used by the Indians, but not yet known, as Mr. Lloyd believes, in commerce. The barks of others are medicinal, or abound in tannin. Ink is made both from gall nuts and a bush called alsifax, resembling the caper. Many valuable resins are extracted from different trees, particularly one distilled from the bark of a tree called the *palo santo*, or holy tree, which is highly fragrant, and is both used as a remedy for disorders, and burnt as incense. The *styrax officinalis* of Linnæus is very abundant—the gum extracted from it selling for two dollars a pound.

The wild animals of the woods are tigers, or rather tiger-cats, being seldom larger than small Newfoundland dogs; lions, at least so called; bears, racoons, sajinos, a species of wild boar, found in droves; wild hogs in herds; conejos, something like our rabbits, but larger; deer, in abundance on the borders of the woods; hosts of monkeys of many species, with wild turkeys, both black and colored; birds resembling our hen pheasants; pigeons, ducks, &c., all excellent eating. The most dangerous animals in the list are the wild hogs, which, when together in a drove, will, if, fired upon, readily attack one or two men. The tiger does not attack men, but freely preys on small cattle.

The isthmus has been famed for snakes and poisonous reptiles; yet Mr. Lloyd did not meet above one or two during his whole stay, and does not describe them. The country people will seldom move after nightfall for fear of them, and always carry about their persons a contra, or remedy, or what they generally consider still more efficacious, a "charm," against their bite. This charm is an alligator's tooth stuffed with herbs compounded and muttered over by some old woman. It is worn round the neck. The "contra" is said to be very efficacious, being a bitter root, called guavito, scraped down, and part of the powder taken inwardly, and part applied to the bite.

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*With the gum flowing from this, and while it is yet liquid, the inhabitants manufacture a sort of water-proof cloth, on the same principle as in this country; but which, thus prepared, is more uniform and never cracks.

A great pest in the country are what are called garrapatas, or ticks, which, in half an hour's walk in summer, will completely cover the person, and are taken from their hold with some trouble. A smaller, but even more insidious enemy, is the peoito (*pulga*) de la Savana, or Savannah flea, not larger than a grain of sand, of a deep vermillion color, and very numerous. They attack the softer parts of the flesh, and occasion a very painful itching. Common fleas, niguas, or chijos, and mosquitoes, are in the usual abundance. Fire flies are common and very brilliant, with other insects, of which many, as Mr. Lloyd believes, have not found a place in our entomological catalogues.

Of the domestic animals, and those chiefly used for food, some notice will be taken in another place.

The seasons are two: summer, or dry, and winter, or rainy. The first commences about the end of December and lasts till April; the latter continues from April to December. The quantity of rain which thus falls in the year is prodigious; but its amount varies in different places. The clouds hang chiefly over the wooded heights; and at Porto Bello, in particular, which is closely hemmed round by them, the rain descends in torrents, frequently accompanied by storms of thunder and lightning of the most terrific description. Where the ground, to any extent, is level, however, and has been cleared of its wood, a great difference is perceptible; and at Panama, the following alternations may be observed. In April, the weather becomes cloudy about noon; but, after drizzling for half an hour, clears up. In May, from nine to eleven, it is dull, with slight rain—the afternoons being still fine. In June, there is a rain every morning and evening; but the mid-days are fair. As the season advances, the rain gradually increases, and is incessant throughout July, August, September, and October. In November, the nights are always wet and cloudy; but, through the day, the sky begins to break. December brings a further improvement. And in January, February, and March, a shower of rain is as uncommon as a gleam of sunshine at the other seasons of the year.

One very remarkable phenomenon occurs throughout the whole isthmus. On the 20th of June, the rain ceases for five or six days; the sun shines out during the whole day with the utmost splendor; nor is any instance known of the irregularity in the recurrence of this break in the ordinary course of the season. It is accordingly reckoned on with great confidence by the inhabitants, kept as a period of social enjoyment, and called *El veranito* (or little summer) *di San Juan*, either from the feast of St. John, which is nearly coincident in time, or, as others say, from the village of San Juan, on the Chagres, and about twenty-three miles from Panama, where the phenomenon is peculiarly observable.

The temperature and salubrity of the climate also vary in different places. Porto Bello is one of the hottest and most unhealthy places in the world. At Panama, on the contrary, the thermometer in the rainy season does not rise higher at night than 82°; in the day than 87°; the winds are variable and cool; and though the rain is incessant, there is thus no stagnation in the atmosphere,

nor consequent epidemic sickness. In summer, the temperature rises to 90,° and even 93°, and in the day the reflection of the sun from the smooth surface of the Pacific, with the heat of the winds which blow steadily from the southeast over a tract of dry savannah, make it very sultry; but the land winds at night are cool, coming chiefly from the adjoining mountains; and the climate may be called generally healthy, though a considerable mortality sometimes occurs. This, however, Mr. Lloyd thinks may almost always be traced to excessive indulgence, especially in the use of raw fruits and vegetables, and occasionally also to the quality of the animal food, which, at particular seasons, is he thinks injuriously affected by the excessive richness of the pastures. The family of the British consul resided four years in Panama without an hour's sickness; and Mr. Lloyd and his companion were seventeen months in the country, during the whole time exposed to the utmost rigor of both sun and rain, yet with entire impunity.

II. *Topographical details.*

Rivers.—There is hardly a mile of land in this whole province which is not in the rainy season intersected by some little river or *quebrada*, which carries off the superfluous water, and is occasionally difficult to pass. But in the summer most of these dry up, and only the following rivers are considered by Mr. Lloyd worthy of particular notice. On the north side, and falling into the Atlantic, the Chagres, Pequeni, Trinidad, and Gatun, which all join and form one before reaching the sea; on the south, or Pacific side, the Rio Grande, the Caymito or Chorrera, the Pacora, Indio, Balliana or Chepo.

The Chagres takes its rise a considerable distance east of Porto Bello, among the high mountains which approach the bay of Mandingo; and after traversing a great tract of country, when nearly opposite Porto Bello, receives the Pequeni, which comes from the southeast, and is as large and broad as itself. The two thus form a noble river, too rapid, however, to be easily navigable; and, accordingly, though canoes ascend both branches in the dry season, even above the common point of junction, the passage is considered dangerous, from the number of falls or rapids, in some of which the stream runs with extraordinary velocity. In proportionate distances, as it approaches Cruces, its rate abates. At that town, which is twenty-three miles direct from the sea, forty-four as the river winds, it seldom exceeds three to three and a half miles per hour, even in the rainy season. At Pena Blanca it runs two miles; at Gatun scarcely one; and at Bruna the current is, in summer, imperceptible.

"Few rivers of its size present more beautiful scenery on its banks than does the Chagres above Cruces. For miles together it is bounded by enormous, abrupt masses of limestone, of the most curious and fantastic forms; in other parts savannahs extend to the very edge of the river, covered with a particularly fine grass called grammalotti; and the noble borgo tree is seen studding the banks,

something in the shape of a well trimmed yew tree, but growing to a much larger size. In most places the river is shaded from the sun's rays by a large tree called jigeron, which extends its branches across the river, its leaves being eagerly sought by the fish. The water generally runs over a bed of various description of pebbles, and is, in summer, most brilliantly clear. In many places, near its source, it is much wider than at its mouth, occasionally breaking into distinct channels, and forming small islands; but in the rainy season these are all connected, and constitute one broad stream, with strong sets and eddies, caused by the abrupt turns, which render its navigation peculiarly perilous. Many years ago, from repeated and long continued rains, the river rose until it arrived at the foundation of the church at Cruces, situate on a small rise, about forty or fifty feet above the present level; the greater part of the town was submerged, and no intercourse could take place among the inhabitants for some weeks, unless by canoes. But towards its mouth, as far up as the river Trinidad, it has never been known to rise more than six or eight feet, and this height the banks easily confine."

The river Trinidad enters the Chagres about twenty-four miles from its mouth, and is also a large river. It rises very near the south coast, not far from the town of Chorrera, which, as will afterwards be seen, gives its name to a considerable river on its other side, flowing into the Pacific. Canoes of various descriptions navigate the Trinidad as far as a large town called Capira, which lies southwest of Chorrera, and bring down produce to Chagres. As high as Mr. Lloyd went up, which was not, however, to this point, the breadth was about two hundred feet, the depth from twenty to twenty-eight feet, the reaches (*calles*) long and straight, without falls or any other impediment to easy navigation.

The Gatun is also of considerable consequence, though neither deep nor wide. It rises in the mountains east of Porto Bello, and crossing both the roads leading from that city to Panama, joins the Chagres in front of the town of Gatun, about eight miles from the sea. Its depth does not exceed from seven to ten feet even at the mouth, shallowing down to four, and even to one a few miles up, and its navigation was further impeded, when Mr. Lloyd visited it, by a number of trees which, having been undermined by its waters in the previous rainy season, had fallen across and still encumbered it. Its importance to the inland communication, however, consists in this—that canoes bound to Porto Bello from Chagres, and which, in stormy weather, when the coast is dangerous, would be altogether wind bound, are enabled to ascend it as far as a village called Aqua Sucia, whence their cargoes are conveyed to and from Porto Bello on men's shoulders. Besides which, several quebradas enter it to right and to left along its course; and all contribute somewhat to facilitate access to the adjoining country. Some considerable lakes also exist in this direction, with which several of them communicate.

With the united assistance of all these rivers, the navigation of the Chagres, below the junction of the Trinidad, is easy, and eve-

superior to many much larger streams. The depth below Gatun varies from twenty-six to thirty feet; above, it is twenty-four, and nowhere falls below twenty two, unless on some few spots, where only sixteen are found, which, however, have deep water close to them. This depth, too, is not in a channel, but the whole breadth of the river, which is from two hundred to three hundred and eighty feet wide. The banks are precipitous, of trap and porphyritic formation, wooded to the very edges, and almost everywhere admit of vessels being brought close to them; and the current, as already noticed, is here very moderate.

The Rio Grande rises to the northwest of Panama, near a mountain called Pedro Miguel; and after receiving several streams, becomes navigable for very large canoes two leagues above its mouth, which is about two miles from Panama; and here a bar runs across it, on which, at low water, there is not more than two feet water. The tide rises, however, so high in the bay of Panama, (about eighteen feet in spring tides,) that vessels easily enter the river, and within the bar have good anchorage. Much interest was at one time taken in this river from the near approach, in some places, of its course to that of the Obispo, which falls into the Chagres a little below Cruces; and from the idea, consequently entertained, that a water communication across the isthmus might be obtained by cutting a canal between the two. The shallowness, however, of the Chagres thus high up, the short and broken course of the Obispo, and the much greater facilities offered elsewhere for establishing a communication by railroad, appear to Mr. Lloyd to be, for the present, at least, insurmountable objections to this plan. Were a great traffic already established across the isthmus, it might become valuable in competition with other routes.

The Caymito, or Chorrera, empties itself into the Pacific about ten miles west of Panama, and is formed by the junction of numerous petty streams which take their rise in different parts of the western cordillera. It is very deep towards its mouth, and the branch called Rio Martin Sanchez continues navigable for large canoes quite up to the town of Chorrera, which thus gives one name to the whole river; the other is derived from the prodigious number of alligators, sword-fish, &c., which infest it. The tide runs very strong in and out of this river, not being impeded by a bar at its mouth; and the anchorage for shipping is thus bad and exposed.

The Pacora and Indio unite before reaching the Pacific, near the island of Chepillo, about eighteen miles east of Panama, and form a broad, rapid, and winding stream for several leagues above their mouth. To the seaward they are protected by innumerable mud banks, between which, at low water, only very narrow passages appear, prodigiously infested with sharks and alligators; but, at high water, the navigation is good, even for large ships, some way up the river, and is open for canoes up the Pacora as far as the town of the same name, and up the Indio for an equally considerable distance. On the banks of the latter, an English gentleman, resident in Panama, has erected a sawmill, capable of sawing from

fifteen to twenty thousand boards annually. An inexhaustible supply of the finest timber is in its immediate vicinity, and the fertility of the soil, where cleared, is such that a small portion, with the labor of two men only, affords an ample supply of every article of subsistence for the whole establishment. Several roads lead to it from the neighboring villages, and one has been formed from a place on the united stream called Sambaja, where the largest class of vessels remain. The boards are rafted down the river, and have a ready sale, not only in Panama, but also in Guayaquil and Peru—in the latter of which there is a scarcity of wood. On the banks at the mouth a wild animal is found called *macho*, or *vacca del monte*, and sometimes, also, *danta*, nearly of the size and appearance of a jackass, which, when shot, is considered a great dainty. All the land between this river and Panama is low and dry.

Ballano, or Chepo, is of great extent, and under the name of Canada, rises in the province of Darien, near the source of another river called Chucunaque, which falls into the Pacific in the gulf of San Miguel. The Ballano receives several considerable streams during its course, which is nearly west, and in some degree parallel to the coast for many miles, until it suddenly turns to the southward, and enters the Pacific a few miles east of the Pacora. It is navigable as far as this turn, and on its banks, a little higher up, is situate the town of Chepo, which is of some consequence as being the assigned place of communication with the Mandingo Indians. Further on is a fort, called Fuerte Terrable, built to prevent their incursions, and the line of the river, generally, is considered the boundary. An extreme, but not active, animosity is still maintained on both sides.

Communication across the Isthmus.—This is at present maintained chiefly by two lines of roads—one from Panama to Porto Bello, the other equally from Panama, by way of Cruces or Gorgona, down the Chagres, to the seaport of the same name at its mouth. There are some others in use, for conveying cattle and other farm produce to and from other points; but they are little known, and under the Spaniards their improvement and multiplication were much discouraged. Mr. Lloyd, however, strongly recommends a new line to be now formed, differing from them all, beginning on the Atlantic, at a fine bay called Limon, or Navy bay, about five leagues east of Chagres; thence to that river, some miles above its mouth, where its course approaches this bay by a canal; thence up the river to a favorable situation on the south bank of the Trinidad, where its shores are excellently suited for being converted into wharves and landing places, both for goods and cattle, and thence, finally, to Panama or Chorrera by a railroad—the latter being the shorter distance, but the former the preferable route, both as conducting to a better seaport, and as terminating in Panama, the capital of the department, and where its trade is already chiefly centered. And his reasons for this innovation will be readily gathered from the following abstract of the topographical

notices bearing on this point, into which he enters in his notes at great length.

The harbor of Porto Bello is most excellent, but such is its dreadful insalubrity that at no period of its history did merchants venture to reside in it, except for a few weeks in the best season, in which was held its great and well known fair. No class of inhabitants can long exist in it; even negroes do not generally support a prolonged residence, and it was firmly believed for a considerable time that it was especially fatal to women in childbirth. Animals of other countries are said, also, to feel the effects of the climate, and do not produce; and Mr. Lloyd states it as at least certain that domestic fowls brought from Carthagena and Panama shortly cease to lay eggs, become emaciated, and their flesh soon gets little better than carrion. Pigs and mules seem to be the only exception, thriving here as in other parts of the West Indies; and toads are most disgustingly numerous. Such a port as this, however, is entirely unsuited to be the centre of a great trade; and, accordingly, the intercourse between the two seas is already chiefly removed to Chagres. But the harbor to seaward is not there equal to what might be expected from the river which it receives and discharges. A ledge of rock runs across its mouth, with not more than fifteen feet of water in the deepest places, and in many rising even to the surface. A heavy surf thus frequently breaks from land to land, and even under the most favorable circumstances no vessels drawing more than twelve feet water can enter the river.

The bay of Limon, on the contrary, is almost five miles wide at the entrance, and can be approached by night or day, in any weather, there being no danger unless quite close to either shore. Its opening is due north. On the western side several projecting points afford secure and commodious anchorage within them, the innermost enclosing what is at present considered the harbor, but which a break-water, formed at little expense of the coral rock which abounds on the shores, and which has been already noticed, would enlarge to any extent that could be required. The bottom of the bay curves regularly, bounded by a beach of very tenacious sand, and beyond by a bank, raised a few feet above high water mark, and formed of shells thrown up by the surf, which, in strong northerly winds, breaks here with some force. About three miles from the east point of the bay the land falls back in another deep curve, within which is situated an island called Manzanilla, a mile and a quarter long, and a mile broad, forming a fine channel with the main land, with excellent anchorage for large ships for some distance within its entrance—and shelter for small vessels to repair or careen, in a large lagoon enclosed between the main land and the southeastern end of the island. The depth of water in the bay decreases regularly from six fathoms to three, two, and one and a half, even close to the shore; and its value as an anchorage is already well known to British vessels on the coast, from whose visits it has acquired the name of Navy bay. Along its shores the land is first studded with cocoa nut trees, which are

succeeded by mangroves, and these again by the dense forest. The climate is comparatively healthy, and the fall of rain moderate, even at present; but when the adjoining woods are more cleared, there is little doubt that it would be still further improved in both respects.

To this bay the Chagres approaches in its course to within two miles and a half, the interval being perfectly level, with the exception of a few abrupt eminences from forty to sixty feet high. The soil is of a stiff clay, covered with stunted wood, and intersected by a few rivulets, or *quebradas*, which in summer are still water, and somewhat brackish. A canal cut in the most favorable direction would come out near the Rio Indio, and as about this point the mean height of the river is nearly that of the ocean, no locks would be required, and the supply of water would be certain and economical. Once on the Chagres, the navigation, as has been already noticed, is easy to the Trinadad; from which, to Chorrera and Panama, Mr. Lloyd's lines are across the interval between the several portions of the cordilleras, where the country is, almost without interruption, low and flat.

The present roads, on the contrary, are not merely objectionable for the reasons already stated, but also from the mountainous nature of the country which they traverse. That between Panama and Porto Bello is, in this respect, greatly the worst of the two, being in many places almost impassable in the rainy season, from the steepness of the ascents and descents, none of which are sought to be avoided. But the roads to Cruces and Gorgona also lead across a mountainous country, and are extremely difficult in bad weather; a considerable portion of the latter, indeed, being merely the bed of what is in winter a considerable stream.

Panama.—The site of Panama has been once changed. Where the old city stood, which is about three miles east of the present situation, was already, when the Spaniards first reached it in 1515, occupied by an Indian population, attracted to it by the abundance of fish on the coast, and who are said to have named it "Panama" from this circumstance—the word signifying, in their language, "much fish." They, however, were speedily dispossessed; and even so early as in 1521, the title and privileges of a city were conferred on the Spanish town by the Emperor Charles V. In the year 1670, it was sacked and reduced to ashes by the buccanier Morgan, and was only after this built where it now stands.

Its present position is in latitude 8° 57' N., and longitude 79° 30' W. of Greenwich, on a tongue of land shaped nearly like a spearhead, extending a considerable distance out to sea, and gradually swelling towards the middle. Its harbor is protected by a number of islands, a little way from the main land, some of which are of considerable size, and highly cultivated. There is good anchorage under them all, and supplies of ordinary kinds, including excellent water, may be obtained from most of them.

The plan of the city is not strictly regular, but the principal streets extend across the little peninsula from sea to sea, and a cur-

rent of air is thus preserved, and more cleanliness than is usually found in the Spanish American towns. The fortifications are also irregular, and not strong, though the walls are high—the bastions having been constructed from time to time, as the menaces of pirates or other enemies have suggested. The buildings are of stone, generally most substantial, and the larger with courts or patios. The style is the old Spanish. Of public edifices, there are a beautiful cathedral, four convents (now nearly deserted) belonging respectively to the Dominican, Augustin, Franciscan, and Mercenaries monks, a nunnery of Santa Clara, a college *de la Compania*, and also the walls of another, which was begun on a magnificent scale, but was never finished, and is now falling to ruins.

Immediately about Panama, east along the coast, and northwest from it, the land is low and flat, but west and northeast the mountains approach it closely; and from a hill, called Cerro Ancon, about a mile west from the city, and six hundred feet high, an excellent bird's-eye view is obtained of the whole adjoining country, including the city, the islands in the bay, the neighboring plantations, the mountains of Veragua, the Pearl islands, the flat country towards Chagres, the elevated chain between Porto-Bello and Panama, the Rio Grande, the low land along the coast towards the Pacora and Chepo, Panama Viejo, &c., all which come successively under review, and together constitute a landscape beyond measure beautiful.

Porto Bello was first discovered in 1502 by Columbus, who thus named it from the excellence of its harbor. It is situated in latitude 9° 34' 35" north, longitude 77° 45' west, close to the sea, at the foot of immense mountains which surround the whole port, and consists of one long street, which circles round the bay, with a few short ones branching off where the ground will admit of them. There are, besides, two *plazas*, or squares—one in front of the treasury, which is built of stone; the other formed on one side by the church, which is also of stone, and capacious relatively to the population, but of late years it has been allowed to go very much to ruin. The same may, indeed, be said of all the public and most of the private works. The hospital and even the fortifications are dilapidated, and of the houses in town only a few remain tenantable.

It has been already noticed that animals brought from other countries speedily degenerate, and cease to produce here; and even the fowls sent from Carthagena, or Panama, shortly giving up laying eggs. All the meat that is consumed is thus sent from Panama, or from some of the hatos on or near the road; and if not immediately killed, the animals become emaciated, and their flesh little better than carrion, though there appears plenty of excellent herbage in the vicinity of the city. For this reason, although in every other part of the country there are numerous cattle estates, not one is to be found in this vicinity, and the only animals that appear to thrive are pigs and mules.

The heat generally is most oppressive. The town being surrounded by mountains, the freshening sea breeze is never felt, and

the immense forests that cover the mountains, and, indeed, the face of the whole country, precluding the passage of the sun's rays to the dry earth, the most dense vapor is continually exhaling, which ascends and forms immense clouds, deluging the country with almost incessant rain. The sun occasionally bursts out with the greatest fierceness, but before it can have any but a mischievous effect, even to dry the streets, it is again enveloped in clouds, and again it rains, clearing up and raining in such rapid succession, morning and night, that the heat is seldom moderated.

The dampness and unhealthiness of the climate, combined with the heat and the immodrate use of spirits, soon succeed in so enervating the constitution that the first attack of an epidemic is generally fatal; and though medical men of eminence have occasionally been induced to settle in Porto Bello, they have seldom found their medicines and learning sufficient to guard even themselves long against the effects of the climate. The city has thus acquired the title of "La Sepultura de los Europeanos."

The population is now extremely limited—the greater part being negroes or mulattoes, with one or two old Spaniards who still cling to their property here. Occasionally a few visiters arrive from Panama with goods, which they dispose of at an exorbitant price; and a small detachment of troops is sent from Panama to do duty for a certain time. But this is frequently relieved, and the survivors look forward with great joy to the day on which they are allowed to depart.

The waters that run from the different mountains are particularly clear, and delicious to drink; but wo to the person who is rash enough to make immoderate use of them, their very excellence being their misfortune, as they cause dysenteries from which few escape; and almost all the fevers of the country degenerate into this disease. They, however, afford the luxury of a cool and refreshing bath, which every one takes a little before noon, and it is considered one of the most important occupations of the day.

As the mountains and forests, which abound with animals of various descriptions, extend to the very foundations of the houses, it is not uncommon to find wild hogs and small tigers near the town, and the latter sometimes make inroads on the fowls and other domestic animals. They are anxiously sought after, however, by the negroes and mulattoes, who frequent the forests as wood-cutters, and are particularly expert in attacking tigers, generally with no other arms than a lance and machete, or very long sabre like knife. With these they seek their hiding places, and, encountering one, with the left arm enveloped in a blanket, they with the lance incense the tiger to make a spring, when they wound him in the tendon of the paws if possible, which makes him retire. The hunter pursues, and generally succeeding in again cutting the paws, afterwards despatches him at his leisure—carrying his head, paws, and skin to Porto Bello as a trophy of his valor, and preserving the skin to make tobacco-pouches, or covers to little easy chairs used in the country.

The great abundance of toads about Porto Bello has been al-

ready noticed. This is so prodigious after rain that the popular prejudice is, that the drops are changed into toads, (*de cada gota hacen un sapo,*) and even the more learned maintain that the eggs of this animal are raised with the vapors from the adjoining swamps, and, being conveyed to the city by succeeding rains, are there hatched. Their large size, however—many of them being from four to six inches in breadth—sufficiently attests their matured growth in more favorable circumstances. After a night of rain, the streets are almost covered with them, and it is impossible to walk without crushing them.

Chagres.—The town of Chagres is one of the most miserable that can be imagined, being situated in a little sandy bay on the north side of the river, open to no wind but a westerly one, and bounded by woods to the south, by a black and dismal looking fortification on a hill to the north, and by a swamp to the east, which is continually fed by springs which have no outlet. It also is thus extremely unhealthy. The inhabitants are chiefly black, or colored, with the exception of a few custom-house officers, and the commandant of the castle. Their number is about one thousand. In entering the river from the sea, the town is not seen till close upon it, and does not look better than a collection of negro huts on a West India sugar plantation, the houses being built chiefly of mud and thatched.

Gatun, Gorgona, Cruces, &c.—Gatun is quite a small village. Gorgona is somewhat larger, being a point where passengers going to Panama frequently land in order to avoid the danger and delay caused by the progressively increasing rapidity of the current as boats ascend to Cruces. Cruces, however, is the place to which goods are always conveyed, and was a village of considerable extent when Mr. Lloyd first saw it, but was accidentally burned down in 1823. When he left it, there were not more than one hundred and twenty houses, built of reeds, occasionally plastered, and neatly thatched. The inhabitants of these places are nearly all owners of canoes or mules, or store keepers for taking charge of goods, or bogas—that is, persons employed in working the canoes, which is done either by paddles or poles, according to the depth of water. Cruces and Gorgona are also resorted to as watering places in summer by the inhabitants of Panama, being considered very healthy; and the town of Chorrera, on the river of that name, falling into the Pacific, has the same advantage.

Gold Mines.—Mr. Lloyd visited the gold mines of Santa Rita and Pequini, both in the mountains of Porto Bello, but could discover nothing but a few shafts, or rather holes, of little depth, which, if they ever were productive, seem now exhausted. He very much doubts, indeed, whether the places shown him as the mines are really those where (according to tradition) large quantities of ore were once obtained; and thinks that some deception was employed—probably to deceive the Spanish government—when they were in activity. They are now almost abandoned.

III.—*Statistics.*

The present department of the isthmus is divided into two provinces, viz: Panama, which includes the Darien, and Veragua; and these again are divided into cantons, having a certain number of parishes in each, as follows, according to a census taken in 1822:

PROVINCE OF PANAMA.

		Inhabitants
Canton of Panama:		
Panama, capital of department		10,730
Parish of	Pacora	657
"	Chepo	1,933
"	Chiman	238
"	San Juan	174
"	Cruces	1,200
"	Gorgona	540
"	Taboga	543
"	Pearl Islands	700
	Total	16,724
Canton of Los Santos:		
Los Santos, capital, distant from Panama 53 leagues.		4,318
Parish of	Parita	2,170
"	San José de Peré	3,142
"	Pocri	1,939
"	Macaiacas	2,338
"	Las Tablas	3,577
"	Baca Monte, or Santa Barbara	1,141
"	Pedasi	1,544
"	Ocu	1,179
	Total	21,348
Canton of Chorrera:		
Chorrera, the capital, distant nine leagues from Panama		4,000
Parish of	Areyjan	834
"	Capira	1,000
"	San Carlos	577
"	Chame	1,000
	Total	7,411
Canton of Nata:		
Nata, the capital, distant 42 leagues from Panama.		4,262
Parish of	Anton	1,281
"	Santa Maria	2,562
"	Penonomé	8,643
"	Ola	360
	Total	17,108

	Inhabitants.
Canton of Porto Velo:	
Porto Velo, the capital, considered to be twenty-two leagues from Panama	1,122
Parish of Santa Rita	76
" Chagres	856
" Palenque	312
" Pta. Gorda	59
Total	2,425
Canton of Darien:	
Tavisa, the capital, distant thirty-eight leagues from Panama	341
Parish of Santa Maria	245
" Fichichi	100
" Pinogana	146
" Molineca	35
" Pucuti	113
" Cana	30
" Chipigana	162
Total	1,172

PROVINCE OF VERAGUA.

Canton of Santiago:	
Santiago, the capital of, distant from Panama sixty leagues	4,668
Parish of Jesus	1,276
" Montijo	1,182
" Punaga	509
" San Francisco de la Montaña	4,387
" Atalaya	785
" Calobre	1,463
Total	14,170
Canton de la Mesa:	
La Mesa, the capital, distant —— leagues from Panama	4,451
Parish of Cañasas	2,642
" Palmas	545
" Sona	1,184
Total	8,782

Canton of Remedios:	Inhabitants.
Remedios, the capital, distant —— leagues from Panama	1,800
Parish of Tolé	409
" San Felix	324
" San Lorenzo	2,477
Total	5,010

Canton of Alange:	
Santiago de Alange, the capital, distant —— leagues from Panama	2,611
Parish of San David	2,385
" San Pablo	312
" Gualaca	842
" Biuaba	242
" Dolega	739
" Boqueron	334
Total	7,465

Summary.

Canton of Panama	16,724	
" Los Santos	21,348	
" Chorrera	7,411	
" Nata	17,108	
" Porto Velo	2,425	
" Darien	1,172	
Province of Panama		66,188
Canton of Santiago	14,170	
" La Mesa	8,722	
" Remedios	5,010	
" Alange	7,465	
Province of Veragua		35,367
Total number of inhabitants in the government of the isthmus in the year 1822		101,550

Most of the cantons are alike in their resources and agriculture, (with the exception of Porto Bello and Darien, which are almost uncultivated,) but distinct reports of the produce of each were not procured. The following specification, however, of that of the canton of Los Santos, in 1827, may serve as an example with regard to cultivation; and a census of the parish of San Francisco de la Montaña is also subjoined:

State of the canton of Los Santos in the year 1817.

Canton of Los Santos.	Men.	Women.	Deaths.	Marriages.	Born.	Slaves.	Houses tiled.	Houses thatched.	In the country. Houses tiled.	In the country. Houses thatched.	Cattle.	Horses.
Santa Barbara	612	589	19	9	42	.....	74	92	14	188	900	132
Macaracas	1,769	1,882	87	16	145	7	136	342	.....	.....	2,000	300
Pedasi	214	214	11	8	16	2	23	110	.....	.....	938	140
San José de Perd	1,753	1,848	102	32	216	17	78	116	63	695	4,846	1,300
Ocu	854	985	101	24	198	11	24	48	2	250	3,669	222
Las Tablas	1,880	1,998	104	12	112	34	163	8	312	.....	7,850	1,230
Pocri	998	1,013	81	11	90	6	31	54	27	506	2,200	390
Parita	1,189	2,227	43	14	110	98	166	489	.....	.....	7,900	419
Los Santos	1,956	3,776	188	33	181	30	684	265	.....	.....	8,321	7,200
	11,225	14,642	736	142	1,060	295	1,379	1,524	418	1,629	39,721	4,564

Statistics of the Canton of Los Santos—Continued.

Canton of Los Santos.	Horses.	Mules.	Goats.	Maize or corn.	Rice.	Sugar.	Molasses.	Skins.	Grease.	Figs.	Cotton.	Salt.
				Fanegas.	Quintals.	Quint's.	Quint's.		Quint's.		Quint's.	Quint's.
Santa Barbara	73	24	7	8,000	90	.....	.....	.....	.....	20	18	.....
Macarascas	40	20	16	200	220	6	100	60	7	50	4	.....
Pedasi	154	3	65	210	929	.....	102	.....	.....	18	.....	.....
San José de Porcé	900	85	150	6,200	2,720	50	246	.....	.....	140	.....	.....
Oca	616	47	26	1,500	48	.....	.....	.....	.....	97	10	.....
Las Tablas	2,635	23	527	2,230	2,000	250	.....	500	60	80	.....	.....
Pocri	220	6	112	3,600	2,950	.....	450	.....	.....	900	.....	.....
Parita	1,576	28	196	1,100	650	96	380	420	60	115	9	.....
Los Santos	2,300	47	220	1,000	500	8	800	405	20	300	11	1,800
	9,544	283	1,319	24,090	9,998	420	2,078	1,385	147	1,715	52	1,800

Rep. No. 45

Census of the town of San Francisco de la Montaña, in Veragua, for the year 1825.

	White.		Colored.		Total.
	Men.	Women.	Men.	Women.	
St. Francisco	2396		2448		5,844
Baptised	63	64	89	53	269
Died	10	15	19	14	58
Married	.....	10	.....	15	25

With regard to the above tables, Mr. Lloyd observes that the division into white and colored is not strict, as most descendants of mestizos, and even mulattoes, if their circumstances are easy, are considered white. And, also, that the excess of baptisms over deaths, in the second table, multiplied by the five years intervening between its date, and that of the previous census, will not give the whole difference between the respective numbers; whence he considers it probable that all those in the first are under stated, and may be increased in the same proportion, in order to give the population in 1827. Some other observations, however, also occur respecting these tables, and may be advantageously interwoven with the additional facts to be yet adduced.

It may reasonably be doubted, perhaps, how far tables of such extreme minuteness regarding a thinly peopled, and by no means highly civilized district, are quite so correct as they pretend to be: but supposing them to approach the truth, a very remarkable disproportion is first observable between the males and females, both in the human species, and, as may be worthy notice, among brutes also, the return of men in Los Santos in 1827 being 11,295 to 14,6[illegible] women: and of horses, 4,564 to 9,544 mares. Of these last, above half were whites, or so considered, all being creole or born in the country. The remainder were colored, chiefly Indians, condemned by their position in society, to servile labor, at a low rate of wages and subsistence, but not slaves: of which latter the return only gives 295 (probably Africans, but not so stated) out of the whole 26,000 inhabitants in the province. The deaths in 1827 were only one in twenty-eight, a very small mortality in a tropical climate, and confirming Mr. Lloyd's previous statements of the healthiness of the western districts of the department. The births were as in twenty-six persons, or thirteen couple: the marriages were only one in 174 persons, or 87 couple: and they were more numerous among the colored than among the white population.

One person in every five had a house, or, in other words, the average number in a family was five, which may be thought to indicate a slow increase. Accordingly, the excess of births above deaths in Los Santos in 1827 was only 324, one seventy-second part of the population, or about one and a half per cent. In the

United States, the increase exceeds three, and approaches to four per cent. Of the houses, a very large proportion, almost a half, are marked as houses in the country, indicating at once security and the prevalence of agricultural occupation; two-thirds are stated as "thatched houses," the remainder as "tiled."

The column marked "cattle" includes both oxen for draught and slaughter. The breed is of good size; and the draught oxen, when well broken, fetch from twenty five to thirty dollars each. Those for slaughter may be bought at from twelve to eighteen dollars each—the best. The race of horses are small, but hardy; and their price varies from fifteen to forty dollars. Mules are said by Mr. Lloyd to be the animals most prized in the country, yet the return of their numbers in the canton of Los Santos in 1827 is so small as strikingly to illustrate his previous statement as to the flatness of the country in this direction; for, in mountainous districts, it is well known no other animal is ever rode. Their price varies from twenty even to one hundred and twenty dollars. The number of goats is also very small, which, at first sight, seems merely to confirm the same fact; but when it is considered that, throughout the West Indies generally, this animal supplies the place of the sheep for the table, and in some degree also that of the milch cow for the dairy, its rarity here leads to a further induction. Pigs are few, and of most exorbitant value. Of a good size and well fattened, they will fetch from thirty to thirty-five dollars each, and are chiefly purchased by women butchers, who, after killing them, cut off every morsel of fat, and sell it separately as lard for culinary purposes.

Fish and fowl are plentiful, cheap, and much used; and in Panama market hundreds of young sharks, of the kind called shovel-nosed, and from one to two feet and a half long, are daily sold for food. The guana* is considered as an especial dainty, as are pearl oysters, and many varieties of game, which are brought in from the woods. Even monkeys are eaten, especially in the country bivouacs, though seldom offered for sale in the town markets.

The chief articles of farinaceous food are maize, or Indian corn, and rice; yet the home growth of each seems very moderate. They are pealed, or shelled, by hand in a rude mortar, made by hollowing out a piece of a large tree; and the operation is so troublesome as to make a great difference in the price of the article before and after it is performed.

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* Thus described: "It has much the appearance of a small alligator, of a yellowish green color, and is very common along the banks of all the rivers, living chiefly on fruit and leaves of trees. It has a peculiar power of running on the top of water, which it does with great rapidity, and apparently with the greatest ease. Its claws seem, indeed, formed for the purpose, having a membrane, or web, resembling that of the duck.

"The eggs of these creatures, when dried, are considered a great luxury. They are little larger than a boy's marble, and have nearly the same flavor with turtle eggs. The flesh also resembles that of the fowl, both in appearance and taste. The Musquito Indians occasionally come to the river Chagres, in companies of twenty or thirty to hunt the guana, which they do with great expertness, chasing them into the trees with small dogs, and shooting them with fowling-pieces. The Americans have taught them to know and use guns with percussion and other locks."

The greater part of the sugar used in the Isthmus is imported in skins from Central America, or from the valley of the Cauca by way of Buonaventura, on the Choco coast. It is thus dear. The home produce is chiefly miel, or molasses, and rapadura, or raw sugar, which are preferred by the inhabitants to the finer preparations. Great quantities of wild honey are found in the woods, the bees collecting which do not sting, and are thus robbed without precaution. No return is made of the manufactory of ardent spirits.

Mr. Lloyd thinks that the statistical table given above of the province of Los Santos may be considered generally as descriptive of the others also, with the exception of Darien and Porto Bello, which are comparatively uncultivated, and of Panama, in which the vicinity of the capital city gives a preponderance over the other way. In general, however, he adds, the eastern and central districts, with the islands in the bay of Panama, are the best cultivated and most populous, Los Santos being one of them. Elsewhere, the landlords keep their estates chiefly in grass to save trouble; and the population is nowhere industrious, though strong and enduring, under occasional fatigue.

Their influence, it is added, is not to be attributed wholly to the climate, or their own original constitutions, but chiefly to the extreme fertility of the soil, and the comparative ease with which a man and his family can derive subsistence from it. With a gun and axe, individuals otherwise unprovided take up their residence in any corner of the woods, and in two or three days will have erected a substantial hut, with upright posts and cross-pieces, as firmly fastened with vines as any nails or clamps could make them, and thatched with the split branches of the wild palm tree, one of the best materials possible against wind or rain. The family at their leisure then form a stage or second floor, to which a piece of balsa cut with notches serves to ascend, and a few stones for a fireplace, an iron cooking pot, and some pieces of wood to sit on, complete the establishment. The nearest trees to the habitation are cut down, fire is applied to the more distant, which, after burning for some days leaves the ground ready for a crop, advantage is taken of the first rainy season to get in the requisite seeds, and for everything else implicit reliance is placed on the gun. None of these people stir, even to work, without their constant companion (generally an old musket) and in an hour or two they are certain of bringing down as much animal food as they can consume in a week, with sufficient besides to barter at the nearest village or town for rice and plantains.

With the indolent habits thus acquired by the free population, and the very small number of slaves in the department, it will appear difficult at any time to command the requisite amount of labor for public purposes; and the actual bad state of the roads seems to demonstrate that this, among other obstacles, is really felt to stand in the way of great improvements. Mr. Lloyd, however, is of opinion that this difficulty would not be insurmountable were a considerable work, of undoubted public utility, (as, for example, cutting his new line of road between the two seas,) to be

undertaken by a powerful company. "There are, within the province," he says on this head, "several regiments of militia, formed of the lower classes of people and Indians, excellent workmen in felling timber and clearing ground, and particularly apt in acquiring any mechanical art. They have advantages over Europeans which, from the nature of the climate, will always exist. Their habits are most simple; with a piece of tasajo or dried beef, a few plantains, and some rice, they are provided with the sustenance on which they live from youth to age; and with a skin in their huts on which to sleep, and a block of wood to sit on, their establishment is complete. Their dress never alters, winter or summer; it consists of a short brown Holland or check shirt, and a pair of caljonjillas or drawers, reaching to the knee, (which are generally cast off when at work;) shoes are known to them only as articles of great luxury; they seldom want anything to protect their feet, and if they do, a piece of hide is used, cut and tied very neatly as a sandal. Their common wages are from two to three reals a day, (from 1s. to 1s. 6d.,) with their meals, which, as they are fed, may cost about 4d. per day more. These men, there is no doubt, the government (under particular circumstances) would gladly place at the disposal of a company, with individuals to command and keep them in order; and, in one instance, this has been already offered, though not accepted, to the extent of one thousand men."

Trade.—The trade of the isthmus is at present at a very low ebb. On the Atlantic shore it is maintained with Jamaica by a British man-of-war, which sails every month, between the 20th and 28th, for the express purpose of carrying letters and specie; with Carthagena, by government vessels, twice a month; and with the same and a few other points by independent traders, which bring freights to Chagres and exchange them. On the Pacific it embraces all parts of the coast, both north and south, which find it their interest to communicate with Europe in this way.

The expense of conveying specie across the isthmus to be embarked at Chagres is as follows: a mule will carry five thousand dollars or ounces, and its hire from Panama to Cruces is six dollars; the municipal duty is one dollar, and another called *pizo* is two reals. From Cruces to Chagres the freight for the same sum is one and a half dollars; the porterage at Chagres is as much more; and the whole charge on it is thus ten dollars and two reals, besides a transit duty of three per cent. on silver and one per cent. on gold. The return trade in goods is at the following rates:

The water carriage from Chagres to Cruces is two dollars the bale, and warehouse room in Cruces two reals more. Thence the goods are carried to Panama, either on mules, or by natives on their shoulders, as the case may be. If the packages are heavy, but strong and compact, mules are employed; but if liable to breakage, or of inconvenient shape for passing carelessly along narrow lanes, and up and down steep acclivities, men are considered the most trustworthy animals. The hire of a mule is, according to the burden and measure, from four to six dollars; and

of a porter, from six dollars upwards, by the same rule. On the arrival of the goods at Panama, they are immediately lodged in the custom-house; and if for exportation, pay a duty of two per cent.; if for home consumption, it is according to the article. And to all these expenses must be added about four dollars on the bale, for extra packing to defend from rain; making in all from 10 to 12 dollars.

In the year 1825 the following vessels were entered at the port of Chagres, exclusive of men of war, packets, and small coasters, viz: one large ship from Bordeaux; seven brigs from Havre-de-Grace; twenty-one schooners, (chiefly British,) from the West India islands; six schooners from the United States; and three from Carthagena. In 1828, these numbers had diminished to eleven schooners from the West Indies, four from Carthagena, and five from the United States, without any French whatever; and it is not believed that the trade has since much revived.

In the same years the entries at Panama were respectively seventeen and twenty-four vessels; the lesser number, on the one side, corresponding to the greater number on the other, and *vice versa*. This would seem to indicate that the whole transit might, with patience and perseverance, be considerably improved; but the spirit of commercial enterprise, which in 1825 was too rash, has ever since been altogether as desponding. The improvement is chiefly exemplified in the trade with Guayaquil, which exhibits only one entry in 1825, and no fewer than eleven in 1828. The passage from Callao to Panama takes usually from nine to twelve days; from Panama to Chagres it occupies three; and from Chagres to Jamaica, six to ten.

Finances.—The following is a statement of the receipts and expenditures of the government of Panama in 1827:

Receipts.	£	s.	d.
Balance from the last year	4,526	7	1
Amount received for stamped paper	1,090	3	1
From provincial treasuries	1,811	0	0
Donations, or voluntary contributions	49	0	0
Assignments	6,000	0	0
Ninths—a species of tithes	5,161	6	1
Loans	80,820	0	0
Aprovechamientos, or from public lands	5,447	3	1
Reintegros, or restorations	939	3	1
Custom-house duties	70,008	3	1
Duties on tobacco	15,820	2	1
Duties on spirits	564	1	1
Record office	491	5	0
Vacantes	7,264	4	1
Auxiliaries to the national credit	1,473	2	1
Capitation tax	4,509	1	1
Deposites	29,704	7	1
	241,682	6	4

Mr. Lloyd adds: "Under the above head of loans, only $32,000 were paid in cash; the rest was $11,789 for rations in meat for the troops; $2,653 in documents to persons holding official situations on account of the scarcity of money; $27,773 advanced by merchants to the military, for which they received documents on the custom-house."

Expenses.

	£	s.	d.
Repaid to persons depositing money	2,283	2	½
Expenses of the hospital	18,406	7	½
Expenses in stamping paper	1,302	1	½
Aid to other treasuries	5,936	1	0
Returned to money lenders	83,582	2	0
Paid by custom-house	277	4	½
Paid by the collector of tobacco	1,429	0	0
Paid to invalids, or retired officers	3,589	5	½
Novenos decimales	1,720	2	½
Salaries of public officers	7,514	0	½
do of treasury	4,546	6	½
Pay to the military	84,792	1	½
Expenses of ecclesiastical meetings	1,225	2	0
General expenses	10,475	2	0
General expenses of fortifications	1,756	2	½
Artillery, or arsenal	2,616	2	½
Vacantes	2,583	2	0
Monte Pio, or fund for relieving government officers	410	2	0
Lepers' hospital	79	0	0
Sundries	617	0	0
do credito del Gorbro Español	3,788	2	½
	238,929	6	0
Balance in the Treasury	2,753	0	0

The following account of the income in 1812 may be advantageously subjoined, as showing what has been, for the present, at least, lost and altered by the separation from Spain.

Income of Panama for the year 1812.

Sealed paper	$2,240
Ecclesiastical duties	5,332
From alcaldes	79
Custom-house	145,000
Quinto, or duty on gold and pearls	778
Tribute by the Indians	300
From other treasuries	19,858
From hospital	536

For invalids (monte pio)	$2,623
Seizures	860
Reintegros	175,180
Borrowed	42,500
Duties on aguadiente	21,200
do powder	2
Deposites	101,000
New duty on aguadiente de Lima (from Peru)	2,800
Fines	1,200
Received from Spain for fortifications	10,000
Ecclesiastical duties in other cantons	2,782
Ecclesiastical duties in other cantons	420
Pope's dispensation bulls	27,000
do do distributed	5,000
Other bulls for sins	7,000
do do	1,500
Duty on tobacco	2,000
do cards	2,000
Turnpikes	1,300
Voluntary contributions	110,000
Received to assist in carrying on the war	31,000
Customs on goods in Cruces	4,000
Military monte pio, or fund	4,500
Ministerial do do	1,400
Received for clothing of militia	5,000
Monte pio for surgeons	251
Extraordinary contributions	9,000
	746,241

Manners, education, occupation, &c.—The upper classes in the isthmus are of the common stock, but by no means so far advanced in civilization as their neighbors. The white people, and particularly the women, are noted for a tinge of European complexion, which can hardly be reconciled with their geographical position. They are the most superstitious, and the least freed from the shackles of their religion, of all the Colombians; and thus, although their communication with the English is considerable, and they admire and profess to imitate our domestic habits, we are not, in general, favorites with them.

The women are retired, and even unsocial, scarcely ever leaving their houses but to mass, or to follow in a religious procession. They are also altogether uninformed, and rear their children in the worst manner, allowing them to associate indiscriminately with the lowest negroes of their own age. Hence, though there is a college at Panama, the head of which is a most excellent, well informed clergyman, and considerable pains are here taken to instruct the youth in mathematics, natural philosophy, and the other higher sciences; yet the formation of their character, and the instilment of honorable principle and right feeling in them, are neg-

lected, and billiards, cockpits, gambling, and smoking in low company, are their exclusive amusements. It is not probable, therefore, that the worst features of the male character here will be speedily corrected, which are indifference to the pleasures of home, and a propensity to low debauch abroad. Their best quality is great liberality to the poor, and especially to the aged and infirm, of whom almost every family of consequence has several regular pensioners, who come every Saturday to receive an accustomed and liberal alms.

A considerable turn for commerce is observable among the inhabitants of Panama; and, from the highest to the lowest, each keeps a shop or tienda. The lower classes, also, pursue different handicrafts; but are rude in all, excepting in goldsmith's work, for one branch of which, viz: plating gold chains, they are famous. The field for this branch of art, however, as for every other connected with luxury, is now much curtailed. At one time, no family in Panama ate off anything but plate; almost every domestic utensil was of the same material, and the women wore a profusion of chains, pearls, and other ornaments. But these have now, for the most part, disappeared, and even much of the church plate has progressively passed through the melting pot to the old world, although, on peculiar gala days, an attempt is still made by some individuals to re-appear in the former style.

The dress of the women is, on these occasions, peculiarly splendid, being what is called "cartagenea," thus described by Mr. Lloyd: "A loose shift of beautiful cambric, with innumerable and immense frills richly worked with lace, is, with a petticoat of the same, fastened at the waist by several massive chased gold buttons. Round the neck are several gold chains, with pearl rosettes, crosses, and rows of pearls; the ear-rings are of the shape of a telegraph, and reach nearly to the shoulders; the fingers are covered with rings; and various combs, studded with rows of pearls, cased in gold, are placed, together with a massive gold bodkin, to great advantage in beautiful hair, plaited in two tails down the back. The feet are barely introduced into a little slipper turned up very much at the toes, and also richly ornamented. The whole effect is elegant and becoming."

The pearls thus tastefully disposed round the person of a fair Panamenian are, it is well known, procured among the islands off the coast by diving. The occupation is very laborious, and success most uncertain; but the pursuit is a favorite one, and the divers are very expert. They generally proceed in companies of several canoes together, each containing six or seven men, who dive in succession, armed with a sharp knife, rather for the purpose of detaching the oysters from the rocks to which they adhere, than for defence against danger. Before descending, they repeatedly cross themselves, and generally bring up four oysters, two under the arm, and two in the hand. The usual time of stopping under the water is from fifty seconds to two and a half minutes. Much has been said of the danger of these fisheries, both from the shark and another enemy called the Manta, which crushes its victim. "But

the shark is ever a coward, and so little a match for an expert diver with a knife that an accident is hardly known."

Many individuals in Panama have made it their occupation for years to collect, in this way, pearls for the formation of necklaces; some of which, after continued labor and changing, are certainly of the most perfect symmetry. But their price is not reckoned according to the marketable value of such articles, but according to the trouble which may have been bestowed in collecting and assorting them, and thus they are often dearer on the spot than in London. Some time ago, a diving bell was sent out by an English company for pearl fishing, but it did not answer their expectation, and several causes may be assigned for its failure. The first and primary was the enormous expense at which the concern was fitted out and supported; after which it was found that the oysters did not lie in banks, as is generally the case, but were dispersed under rocks and in uneven ground; and that a peculiar ground-swell and motion under the water, with a very strong current, made it almost impossible to place the bell in safety and to advantage.

Account of levellings carried across the isthmus of Panama, to ascertain the relative height of the Pacific ocean at Panama, and of the Atlantic at the mouth of the river Chagres, accompanied by geographical and topographical notices of the isthmus. By John Augustus Lloyd, esq. Communicated by Captain Sabine, secretary of the Royal Society.

In November, 1827, I received a special commission from General Bolivar, to make a survey of the isthmus of Panama and Darien, in order to ascertain the best and most eligible line for a communication (whether by road or canal) between the two seas. On my arrival in Panama, in March, 1828, I was joined by a brother officer of engineers, a Swede in the Colombian service, a good mathematician, and of habits of great correctness in observation.

Upon consulting together, we found that we could combine the particular object of the commission with a second object in which we both felt a deep interest, namely, the determination of the relative height of the ocean on either side of the isthmus; and that we could best accomplish both, by taking a part of the present line of road between Porto Velo and Panama, until we should fall in with the river Chagres, about twenty miles above Cruces, which village is the usual landing place for all articles of commerce in their transit from the North sea to Panama.

To avoid delay, we commenced our operations on the 5th of May, although the rainy season had for some days set in; being resolved to overlook the absence of personal comfort, the unhealthiness of the season to a European constitution, the inadequacy of our means, and various other difficulties unnecessary to enumerate, as we finally succeeded in surmounting them.

The instruments used for the levelling, were a 20-inch spirit

level of Carey's best construction, with extra telescopes, levels, shade tubes, &c., which I received from the museum at Bogota; a pair of excellent station staves, made by Harris, and graduated as usual, with vernier scales, added by myself, to read off to thousandths of a foot when required; Gunter's chains; an excellent 10-inch theodolite by Carey; and a very fine altitude and azimuth circle for the survey.

Our first level commenced at the end of the street called Calle Sal si Puede, in the suburbs of Panama, and at the point of a bay called Playa Prieta, at spring tide high water mark, observed two days after full and change, which I had subsequently the opportunity of verifying on my return to Panama, and of ascertaining that it was 3.03 feet lower than the extreme rise of occasional tides under the influence of particular winds. From this point we followed the old road to Porto Velo, and after 732 pairs of levellings in a distance from Panama of 1,828 chains, (23¼ miles,) we arrived at the banks of the Chagres on the 30th of June, 633.32 feet being the greatest height we had passed over; and after building a secure station on the bank, 169.84 above the level of high water mark in the Pacific, we finished our operations for that year, on account of the great inclemency of the season, the sickness and debility of the people employed, and from our own constitutions beginning to suffer by continued exposure to incessant rains, with generally no other covering than tents and ranchos, or small huts built by ourselves.

On the 7th of February, 1829, the dry season having for some time set in, we resumed our levelling at the station at which we had desisted the year before, having the instruments in good repair; and, having descended to a station on the river fixed on for the purpose, we found the surface of the water to be 152.55 feet above high water mark in Panama.

We now followed the course of the river, and were enabled thereby to take longer levels than before, which were made with the greatest possible care, reducing the observations to the true levels by the most exact tables for the curvature of the earth.

After 68 pairs of levellings, we arrived at Cruces, in a distance of 1,546 chains, (19¼ miles,) and found a fall in the river of 114.60 feet, leaving only 37.96 feet above the Pacific. Having nearly 50 miles more to descend, and finding so great a fall in 19 miles, we were led to expect a greater fall than 37.96 feet in the remaining distance; and consequently, at this stage of our operations, to apprehend that we should find the level of the sea at Panama to be higher than at the mouth of the Chagres.

From Cruces to a town called Gorgona, distant 419 chains, (5¼ miles,) there is a fall of only 16.13 feet, and thence to a small gravel bank named by us "Playa de los Injenieros," distant altogether 1,302 chains (16¼ miles) from Cruces, we found a fall from Gorgona of 21.82 feet, to a station precisely level with the high water mark of spring tides in the Pacific, still being 34 miles from the mouth of the river. From this point we descended below the level of high water mark of the Pacific, until we arrived at a

place called Palo Matias, distant from Cruces 2,682 chains, (33½ miles,) and from the commencement of the levels in the river 4,237 chains, (52½ miles;) at this point we first observed the effects (slight as they were) of the tides of the North sea, and the height of the water was 13.65 feet below the high water mark at the Pacific: this we therefore concluded to be the level of high water mark in the Atlantic. We however continued our levellings 507 chains further, to a place called La Bruja, nearly twelve miles distant from the mouth of the Chagres, where the water in the dry season is very brackish, and from whence there is no perceptible current to the sea: here we found the level of the surface of the water, by several observations at the time of high water in Chagres, to be 13.55 feet below the high water mark in the Pacific, being 0.1 of a foot less than at Palo Matias, the difference being occasioned by our not having observed the tides at the former place so correctly as at the latter, as we determined to finish the observations at La Bruja. After 935 pairs of levellings, therefore, in a distance of nearly 82 miles, we found high water mark in the Pacific to be 13.55 feet higher than high water mark at La Bruja, which, from the circumstances above mentioned, is considered to be the high water level of the Atlantic at Chagres.

The details of all the operations connected with the levellings are contained in a manuscript deposited in the library of the Royal Society; they are further illustrated by a section of the whole on the scale of four inches to a mile.

No proof levels were taken. I was aware, from the commencement, of the nature of the task I had entered upon, and knew too well that if I had the good fortune to be able to persevere a sufficient time to carry the levelling across the isthmus, I should be but little capable of remaining during a third year, which such verification would have required. I therefore adopted such a scrupulous and rigid mode of proceeding as would render a verification unnecessary, and prevent the intrusion of even a trifling error; an important one, I am bold to say, was nearly impossible. In the whole distance overland to the river Chagres, my companion being employed with the chain, I was assisted by a Spaniard whom I had previously instructed in the management of the station staff. By means of signals I made him adjust the cross piece correctly to the horizontal wire of the telescope; he then brought me the staff, which I read off and noted down the reading; he resumed his station, I examined the level again, adjusted the staff, recalled the Spaniard, and read off a second time.

From the Chagres to the last level my companion had the station staff himself, which, when adjusted to the cross wires, was read off by him. I then re-examined the level, adjusted the staff a second time, and he again read off, writing down the two observations in distinct books, which were compared in the evening. The instrument itself I proved on most days after work, by making a set of eight or ten levellings in a circle; returning in the last station to the point from which I first started, and finding the sum of the difference of the levellings amount to zero.

The point from which the levellings commenced at Panama is marked by a large stone cut for that purpose in the wall at the edge of the sea in Playa Prieta; and the concluding point at La Bruja, by a tree cut down to the exact height marked in the observation book above the surface of the water; the height of the section of the tree is 6.848 feet below the level of high water spring tide at Panama. No better means of marking this level presented itself at La Bruja; but, by reference to the manuscript detail of the observations preserved in the library, several stations are to be found in the vicinity which are not liable to decay.

By careful and continued observations, I found the rise and fall of the tide in the Pacific, at Panama, as follows: between the extreme elevation and depression of the waters by occasional tides there is a difference of 27.44 feet, and the mean actual rise and fall two days after full moon is 21.22 feet.

At Chagres, I observed the rise and fall of the tide at the close of the dry season, in April, 1829, to be 1.16 foot; and being there subsequently during the rainy season, I had an opportunity of observing that the high water mark was the same in both seasons.

The time of high water is nearly the same at Chagres and at Panama, namely, at 3h. 20m. at full and change; hence the following interesting and curious phenomena are deducible in respect to the difference of level of the two seas:

First. High water mark at Panama is 13.55 feet above the high water mark of the Atlantic at Chagres; half the rise and fall of spring tides is, at Panama, 10.61 feet, and at Chagres, 0.58 of a foot; and assuming half the rise and fall above the low water of spring tides to be the respective mean levels, the mean height of the Pacific at Panama is 3.52 feet higher than that of the Atlantic at Chagres.*

Second. At high water, the time of which is nearly the same on both sides of the isthmus, the Pacific is raised at mean tides 10.61 feet, and the Atlantic 0 58 of a foot, above their respective mean levels; the Pacific is, therefore, the highest at such times by (10.61 — 0.58 + 3.52 =) 13 55 feet.

Third. At low water, both seas are the same quantities below their respective mean levels; therefore the Pacific is lower than the Atlantic by (10.61 — 0.58 — 3.52 =) 6 51 feet.

In every twelve hours, therefore, and commencing with high tides, the level of the Pacific is first several feet higher than that of the Atlantic; it becomes then of the same height, and at low tide several feet lower; again, as the tide rises the two seas are of one height, and finally at high tide the Pacific is again the same number of feet above the Atlantic as at first.

Almost every person who visits Panama from the Atlantic side is disposed to think that the country rises from the Atlantic to the

* The author is aware that there are different opinions with regard to what is the mean level of the ocean; the assumption in the text is conformable to his own opinion, but as the data are given from which the conclusions are drawn, every person is furnished with the means of making his own deductions.

Pacific. The ascent of the river Chagres, particularly when swollen by rains and its current rendered more than usually rapid, is very toilsome; and on reaching Cruces, after a four or five days' tedious journey, a traveller is impressed with the persuasion that he has gained a considerable elevation above the sea he has quitted; this impression is not diminished by the journey to Panama, which is mostly through rough and rugged passes, continually ascending and descending; and when, on arriving in the savannahs, a few miles from Panama, the city is beheld for the first time with its conspicuous cathedral, the general exclamation is, "I thought Panama had been near the level of the sea." Such is actually its situation; but as the valley from which it is first seen is several feet below the level of the sea, the first and strong impression produced is that the city stands upon an eminence.

Topographical and geographical notices.

In the map which accompanies this memoir, the coast line on both sides of the isthmus is taken from the best Spanish authorities, including some very recent corrections; the interior is wholly from my own observations.

The district which extends from Panama along the old road to Porto Velo, as far as its meeting with the river Chagres, and for three to five miles on either side, is from a survey made by my companion Captain Falmarc and myself, whilst levelling through this part of the country, in the operations already described. The angles and bearings were taken with a 10-inch theodolite by Carey, with a needle as exact as could be provided for an instrument of that size. On a separate plan (in MSS. deposited in the Society's library,) are marked the stations of the survey, and the intersection of the bearings taken from them. The principal stations are as follows: The Cerros or mountains of Ancon, Caledonia, Vidrio, Lirio, Algarobo, Pelado, Largo, Gordo, San Sonati, Alto, de Las Lajas, Maria Henrique, Grenadilla, &c.

From these stations the surrounding country was sketched at once on the rough map; the same mode was continued from the point where the levellings intersected the river Chagres to the mouth of the river, including as much of the surrounding country as could be laid down by intersecting bearings, taken on either side of the river.

The country west of the road from Cruces to Panama, including a few miles of the coast by Arayjan and Chorrera, was traversed in various directions with a compass, every accessible eminence was ascended, and views taken of the country.

The country between the northern banks of the river Chagres and the North sea was examined and sketched in an excursion in which I ascended the river Gatun with a boat compass, and crossed from thence on foot by the gold mines of Santa Rita, (where I gained a fine view of the northern coast to La Ensenada de la

Minas,) and thence to the sea beach; from this point I pursued the coast line to Porto Velo, and recrossed the isthmus to Panama on foot in the route marked in the map, which is the old and only road from Porto Velo to Panama, taking careful bearings from eminences over which I passed, and gaining as many views of the surrounding country as I possibly could, by climbing the highest trees with a small tomahawk, particularly noticing the direction and figure of the cordillera to the east and west.

The more direct line from Porto Velo to Panama, passing through the river Chagres at a place called Calle Limon, is laid down from a manuscript furnished by a Spaniard, who, with a circumferentor and a cord of 200 varas, crossed from Porto Velo to Panama as nearly north and south as possible.

It is generally supposed in Europe that the great chain of mountains which, in South America forms the Andes, and in North America the Mexican and Rocky mountains, continues nearly unbroken through the isthmus. This, however, is not the case; the northern cordillera breaks into detached mountains on the eastern side of the province of Veragua. These are of considerable height, extremely abrupt and rugged, and frequently exhibit an almost perpendicular face of bare rock. To these succeed numerous conical mountains, rising out of savannahs and plains, and seldom exceeding from 300 to 500 feet in height. Finally, between Chagres, on the Atlantic side, and Chorrera, on the Pacific side, the conical mountains are not so numerous, having plains of great extent intervened, with occasional insulated ranges of hills of inconsiderable height and extent. From this description, it will be seen that the spot where the continent of America is reduced to nearly its narrowest limits, is also distinguished by a break for a few miles of the great chain of mountains, which otherwise extends, with but few exceptions, to its extreme northern and southern limits.

This combination of circumstances points out the peculiar fitness of the isthmus of Panama for the establishment of a communication across.

On the east of the line, from Panama to the bay of Limon, the mountains again commence, gradually thicken, and become more elevated, until they connect and form cordilleras extending from Porto Velo to the Bay of Mandinga, from whence there is another break in the province of Darien and Choco; after which, the land rises into a cordillera on a very extended scale and of very great elevation.

Two lines are marked on the map, commencing at a point near the junction of the rivers Chagres and Trinidad, and crossing the plains, the one to Chorrera and the other to Panama. These lines indicate the directions which I consider the best for a railroad communication. The principal difficulty in the establishment of such communication would arise from the number of rivulets to be crossed, which, though dry in summer, become considerable streams in the rainy season.

The line which crosses to Chorrera is much the shortest, but the

other line has the advantage of terminating in the city and harbor of Panama.

The country intersected by these lines is by no means so abundant in woods as in other parts, but has fine savannahs, and throughout the whole distance, as well as on each bank of the river Trinidad or Capira, presents flat and sometimes swampy country, with occasional detached sugar-loaf mountains, interspersed with streams that mostly empty themselves into the Chagres.

Should a time arrive when a project of a water communication across the isthmus may be entertained, the river Trinidad will probably appear the most favorable route. The river is for some distance both broad and deep. Its banks are also well suited for wharves, especially in the neighborhood of the spot from whence the lines marked for railroad communication commences.

As the river Chagres has been greatly dwelt on in the writings of those who have discussed the probability of communications being established between the two seas, and as considerable expectations have been formed of the facilities it might afford towards a water communication, I have given a separate plan of the river from its mouth to the point at which it was intersected by the levellings. (This plan will not admit of reductions within the compass of the plates in the Philosophical Transactions, but will remain in the society's library, where it may be consulted. A plan of the river on a less minute scale is contained in the general map.)

The distances along the river were measured by a strong line, of 10 chains in length, substituted for the usual measuring chain, properly subdivided, and its length occasionally verified; the cord was borne usually by five men, but when required in the shallow and rapid water, by as many as ten men; and when the water became too deep for the men to wade, canoes were employed to stretch the line. The soundings were taken by a man with a sounding line, marked to half feet, seated behind me in the canoe, so that I could observe the line myself at every cast. The casts were generally between 30 and 40 yards from one another, and the depth of water was inserted in a sketch of the river which I was at the same time engaged in making.

The river, its channel, and the banks, which in the dry season embarrass its navigation, are laid down in the manuscript plan with great care and minuteness. It is subject to one great inconvenience, that vessels drawing more than 12 feet water cannot enter the river, even in perfectly calm weather, on account of a stratum of slaty limestone, which runs, at a depth at high water of 15 feet, from a point on the main land to some rocks in the middle of the entrance of the harbor, and which are just even with the water's edge: which, together with the lee current that sets on the southern shore, particularly in the rainy season, renders the entrance extremely difficult and dangerous. The accompanying plan of the harbor will sufficiently explain the inconveniences it is liable to.

The value of the Chagres, considered as the port of entrance for all communications, whether by the river Chagres, Trinidad, or by railroads across the plains, is greatly limited from the above mea-

tioned causes. It would prove in all cases a serious disqualification, were it not one which admits of a simple and effectual remedy, arising from the proximity of the bay of Limon, otherwise called Navy bay, with which the river might easily be connected. The coves of this bay afford excellent and secure anchorage in its present state: and the whole harbor is capable of being rendered, by obvious and not very expensive means, one of the most commodious and safe harbors in the world.

By the good offices of his majesty's consul in Panama, and the kindness of the commander of his majesty's ship Victor, I obtained the use of that ship and her boats in making the accompanying plan of this bay. The shores are laid down trigonometrically from a base of 5,220 yards, the situation of which is marked; and the soundings were taken by myself, with the assistance of the master. It will be seen from this plan that the distance from one of the best coves (in respect to anchorage) across the separating country from the Chagres, and in the most convenient track, is something less than three miles from a point in the river about three miles from its mouth.

I have traversed the intervening land which is particularly level, and in all respects suitable for a canal, which, being required for so short a distance, might well be of sufficient depth to admit vessels of any reasonable draught of water, and would obviate the inconvenience of the shallow water at the entrance of the Chagres.

I have felt that I might be expected to state my own opinion of the mode that offers the greatest facility for communication across the isthmus, since my examination and surveys were made for that specific purpose, and I have accordingly done so; but I have endeavored at the same time to render the topographical representation of the country sufficiently detailed to enable others to draw such conclusions as may perhaps deserve to be preferred to mine, with almost as much advantage as if they had themselves visited the country.

For the opportunities that I have thus enjoyed of contributing correct topographical knowledge of a part of the world which, from its peculiar locality, has attracted much philosophical and commercial interest, I am indebted to the authority and support which I received from General Bolivar; I am also indebted to his liberality for permission to make public the information I have acquired.

In a country in many respects so unsettled, it will readily be imagined that the authority and countenance derived from a government far from the spot, are not alone sufficient to enable a foreigner to carry through operations so extensive and long continued as mine were. I am sensible that I could not have completed them, had it not been for the frequent assistance and constant support which I received from the friendship of Malcomb MacGregor, esq., his majesty's consul at Panama.

Report of the survey of the isthmus of Tehuantepec, executed by order of the supreme government of Mexico, under the superintendence of General Don Juan Orbegoso, in the year 1826.

It is unquestionable that nations derive great advantages from the establishment of means of communication by water, or by carriage roads, when the former are impracticable, for the purpose of transporting either the goods required for their consumption, or those which constitute their exports.

In this light, the isthmus of Tehuantepec is undoubtedly one of the most advantageous spots to be found within the limits of this wide spread republic. It only extends, in breadth, from 18° 10' to 18° 8' north latitude—less than 51 leagues of 5,000 *varas** each, in straight line. The river Coatzacoalco† traverses, almost perpendicularly, two-thirds of its territory; and, even in its present natural and unimproved state, is navigable almost to its source. The inconsiderable elevation of the Sierra Madre, or main ridge, which divides it in its length, measuring some 1,300 *varas* in height, in its most accessible region, and the lagoons east of Tehuantepec connect it with the sea, and lessen its breadth by six leagues more. Under these circumstances, the impediments in the way of a communication are so far removed that, although, in my opinion, the obstacles to be encountered in establishing an uninterrupted passage by water from sea to sea are unfortunately almost insuperable, it will always be easy to effect it by means of a route, partly by land and partly by water, which, by lowering the freights to an enormous extent, will, in its progress, give life to that fertile soil, and create an extensive commerce, profitable to the whole nation, and destined to promote the speedy transportation of the merchandise of both hemispheres across the seas; it would open a convenient outlet for the indigenous produce of both our coasts, and for the internal staple of the neighboring States.

As a measure conducive to the acquisition of positive data on which to form a correct judgment concerning the works best adapted to the nature of the isthmus, his excellency Don Guadalupe Victoria, president of the confederation, has been pleased to appoint a commission under my supervision; and it has now the honor of laying before his excellency the result of its investigations, although aware that the nature of its proceedings has necessarily been influenced by difficulties encountered in the fulfilment of its trust.

My own limited information, the inability of procuring efficient aid, the want of adequate instruments, and finally, the unfavorable state of the weather, the rainy season having already set in, have thrown obstacles in the way of the undertaking which claim a partial forbearance from the government with regard to such re-

* The Spanish vara is equal to ——.

† So written in the original report—more commonly known as the Guazacoalco.

sults as may fall short of its expectations in so vast and important a matter. The most material questions, however, connected with the communication between the two seas, through the intervening Isthmus, have, in my opinion, been solved.

The river Coatzacoalco, which empties into the Gulf of Mexico in 18 degrees 10 minutes and 27 seconds north latitude, and 4 degrees 42 minutes and 22 seconds longitude east of Mexico, is its most prominent feature. Its mouth, which has only 14 feet water, could be deepened. Sufficient draught for vessels of all descriptions is then found for several leagues into the interior. The tides at the mouth are almost imperceptible, and the channel, which forms its deepest part, never varies in position. This circumstance would facilitate the removal of the bar at the entrance, and maintain the passage free for that class of vessels which are generally employed in commerce.

The Coatzacoalco takes its rise east of Santa Maria Chimalapa, in the Sierra, which marks the boundaries of Tobasco, Chiapa, and Oajaca. The exact situation of its source is unknown, on account of the dense forests which cover the surrounding wilderness.

In the northeast, three leagues above Santa Maria Chimalapa, the river takes an almost westerly direction, through a region a hundred and ninety *varas* above the level of the sea. It is at this place that the rivers Pina and Chimalapilla fall into the Coatzacoalco on its right, not far from each other. It then runs at a distance of about half a league from Santa Maria Chimalapa, situated in 16° 52′ 30″ north latitude, and 4° 26′ longitude east of Mexico.

The altitude of Santa Maria is three hundred and forty *varas* above the level of the sea. Between this place and the confluence of the above mentioned rivers, the road rises to more than forty *varas* above the village, and a hundred and ninety above the river.

During the existence of the Spanish government, pine timber was cut in these sierras for the masts of vessels in the dock yard of Havana. It is from this circumstance that the river received in this place the name of *Rio del Corte*—river of the cutting—which it still retains. Pine trees are now growing on its banks.

Somewhat below Santa Maria Chimalapa, the Coatzacoalco is joined on its left bank, first by the Milagro river, and then by the Tecualapa. Both run down the Sierra ridge to the left of San Miguel Chimalapa. It then takes a northwesterly course, and the elevation of the hills which enclose it gradually decreases.

A river, called by Tadeo Ortiz the Alaman, formed by the junction of the Malaguera and the Malatengo, flows into the Coatzacoalco, towards the north, about ten leagues from the Hacienda de la Chivela, situated in 16° 42′ north latitude, and 4° 5′ longitude east of Mexico. The Malaguera is formed of the streams flowing north of San Miguel Chimalapa, and another running through the grazing fields of the Hacienda de Tarifa. There they all mingle with the waters of the Almoloya, which descend from the great ridge of the Sierra Madre, southeast of Chivela. The Malatengo,

and the Cituni, which joins it opposite Petapa, run down the same sierra, west of this village.

Six leagues further, the Sarabia unites with it on the left; it then flows from the southwest, east of the Sierra de los Miges, and passes west of Chichicovi. From this place the river takes a northerly course, though making long and frequent windings; it then runs westwardly, receiving about six leagues below, and on the same side, the Jurumuapa—also called Arrayo de la Puerta—which, like the former, comes from the east. During the rainy season, the Jurumuapa is ascended almost as far up as Chichicovi, in the canoes employed in the now insignificant trade carried on by the town of Tehuantepec through the Coatzacoalco. During the dry season, the canoes ascend the main stream as far as a place named El Mal Paso*—the bad ford—on the confluence of the Sarabia. But this spot is more distant from Chichicovi than La Puerta, which is therefore the place of resort for the remainder of the year.

From this place the Coatzacoalco turns again to the north, until it unites on the left with the Miges or Jaltepec, a river of some magnitude, six leagues in advance of the Jurumuapa. The Miges rises in the lofty sierras of the same name, forming a part of the Sierra Madre, or main ridge, and follows an almost easterly course. It is probably owing to the impulse given by its current, as also to the nature of the soil, that the Coatzacoalco runs eastwardly until it empties into the sea.

The Chalchijalpa flows into it at about six leagues in advance of the Miges, and on the opposite bank. Its course is unknown, though it seems to run from east-southeast.

Two leagues below, in a spot called the Horqueta, the Coatzacoalco separates into two branches, which, uniting nine leagues further, form the island of Jacamichapa. Into one of these branches of the Coatzacoalco, and south of Acayucam, flows the Manuapa river, which probably comes from the southwest.

The Cuachapa flows into it on the right, three or four leagues below the island, above mentioned; it runs in the same direction as the Chalchijalpa. On the left is the Tlacojalpan creek, which passes by the village that takes its name. It is navigable for schooners almost to this place, and gradually decreases in breadth as far as Jaltipa, six leagues east of Acayucam.

Not far from the mouth of that creek, where a cluster of islands not inconsiderable in size is to be seen, is the Paso de la Fabrica, whence the river flows for a considerable distance almost due east, a wide, deep, and imposing stream. A league below, the Uscanapa river, coming from the southeast, discharges into it, on the right; and another league further, the San Antonio, which, like the former, runs from the southeast, passes by the villages of Isbuatlan and Mulunean.

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* El Mal Paso is really situated about two leagues above the confluence of the Sarabia, and obstructs the navigation of the Coatzacoalco. It appears to be formed of a bank of stone, which interrupts the stream. No river of this name is now seen, as is stated in the incorrect maps hitherto published.

Finally, three leagues farther, and about one league from its mouth, is the confluence of the navigable river of the Calzadas. It runs from the west, and flows into the Coatzacoalco, on the left, forming an island by emptying one of its branches into the sea, at a place called La Barrilla. Another branch extends almost as far as Acayucam, the principal town of that department.

During the rainy season, the beautiful Coatzacoalco overflows its banks for a considerable distance. On its borders are seen huge specimens of the most valuable trees of the equinoctial region, which are entirely useless, owing to the total want of population, though every natural facility exists for their transportation.

Lofty palms (*layates and coyoles*) tower above the forest trees; their trunks are invisible through the thick bushes and innumerable plants, with which the earth is covered. The enchanting view is presented to our eyes of an unbounded, impenetrable forest, which, like a dike of verdure, stays the rapid current at every winding of the expanding stream, as if to thwart its efforts, or protract its course. From the confluence of the Miges, or Jaltepec, the hills gradually begin to assume a crowded and more lofty appearance, mingling at last with the northern slopes of the Sierra Madre, which commences at the Paso de Sarabia. As far as this place, the river is imbedded between banks of slate. The difficulties of the bar at the mouth being overcome, the wide and clear stream of the Coatzacoalco is navigable in its actual condition, for vessels of any burthen, as far as Tlacojalpan creek, seven or eight leagues from its mouth. Thenceforward, its depth decreases irregularly; however, as it has at least fifteen feet water, it is navigable for small craft as far as Mistan Grande. At this place, the first shoals are seen: they are probably formed by banks of hard clay, which the river has been so unable to remove. In consequence of the resistance met by the waters, the Coatzacoalco washes away its banks, thereby enlarging its stream, and lessening its rapidity. Deposites of sand and gravel are thus formed, which render it only one foot deep at the termination of the dry season. These impediments, which are at first of frequent occurrence, might be removed either by restricting its bed, or by deepening its channel, so as to collect the waters. However, from this place, only river boats, such as barges or flat-bottomed vessels, should be employed.

Beyond the three first shoals is a place called Piedra Blanca, whence they become so numerous, that, in the month of May, we counted twenty-one as far as the confluence of the Sarabia; all of them so shallow that our canoes, drawing one foot water, always grounded, and had to be dragged over the gravel to be put afloat.

In view of the impediments presented by these shoals, and by rapids formed from similar causes, with a difference of level of one foot in every three, the idea is suggested of constructing a canal along one of its banks, (the eastern or right would be preferable,) from Piedra Blanca to its head waters. Thus, by abridging its course, its navigation would be shortened by many leagues.

Most of these obstructions might probably be removed by merely deepening its channel—an operation not all difficult in my opin-

ion, as the shoals which interrupt the stream are, to all appearances, formed of clay. By means of locks, the barrier opposed by the larger ones could be easily obviated. They would principally be required for two considerable shoals of slate—one situated somewhat below the junction of the Sarabia, the other between this river and the confluence of the Alaman. At all events, it would be both easy and profitable to render the Coatzacoalco navigable as far as the confluence of the Alaman.

All the soil from the confluence of the Sarabia to the sea is alluvial, argillaceous, and in some places sandy, indicating the decomposition of the mountains of slate and granite, whence the earth, which forms them, descends. From the Sarabia to the neighborhood of Santa Maria Chimalapa, the Sierra Madre presents a formation of slate, which passes through all the varieties common to this rock. This formation extends from Chichicovi to San Miguel Chimalapa, and from the Sarabia to the South sea—a distance of twenty leagues from east to west, and thirty leagues from north to south. Now and then, it is overlayed by secondary limestone. Granite is visible in the neighborhood of Santa Maria Chimalapa; towards the east, it appears divested of the slate by which it has been covered.

I have only seen hard porphyry, of an aluminous base, tinged with blue by crystals of feldspar and hornblende, in the mountain pass of Ladevi, south of the Sierra Madre, on the side of the Petapa. In the isthmus I have not met a single volcanic product.

The great ridge of the Sierra Madre, which extends from the limits of the States of Puebla and Vera Cruz, traverses that of Oajaca from northwest to southeast, and turns eastwardly as it enters the isthmus. It nearly reaches the South sea through the Hacienda de Chivela and Venta (tavern) de Chicapa; then turns to the northeast, and finally recedes again to the east, there marking the boundary between this republic and Central America.

The summits of this ridge are so considerably depressed, on entering the isthmus, that it affords a passage south of Petapa, seven hundred *varas* above the level of the sea, in the mountain pass of Chichicovi. In other passes, or gorges, in the vicinity of the Chivela, and south of it, it is merely three hundred *varas* high, and four hundred and seventy in that north of San Miguel Chimalapa. From this place it gradually ascends as far as the mountain of La Gineta, between the States of Chiapa and Guatemala, which is one of the loftiest peaks in this region.

The northern slope of this ridge advances into the isthmus about fifteen leagues. Its declivity is gradual, if we overlook its valleys and hills. Not so with the southern one; for, with a declivity of two hundred *varas* in three leagues, it reaches the extended plain, separating the Sierra Madre east of Tehuantépec from the lagoons, which, in the form of an extensive bay, are connected with the Pacific ocean. This plain is alluvial—the residue, of the slate of which the adjoining highlands are formed. The slate itself is seen in some places in this plain, which extends to the lagoons, and even to the sea shore, in the form of islands, capes, and inlets. It is about six leagues wide from the ridge to the lagoons. The

upper lagoon is nearly four leagues in breadth. Its outlet, called Barra de Santa Ferera, is three leagues from the Boca Barra—a name given to the place in which both empty their waters into the sea. This second bay, or upper lagoon, runs nine leagues to the west, in the form of a creek called Filima, and thirty leagues to the east, as far as the Barra de Fonalá.

There is little depth of water in either lagoon—the channel in the centre of the lower one having but sixteen feet water (Spanish measure). The bar called Boca Barra, which obstructs its communication with the sea, we were unable to sound, as it could not be reached in the imperfect canoes of the natives; but, from the existence of breakers when the wind was light, and even in a land breeze; in a season, too, in which hurricanes do not occur, I infer that the water cannot be more than six feet deep, on an average. It cannot rise above a *vara* in high tide. The Boca Barra is 16 degrees 13 minutes north latitude, by 4 degrees 22 minutes longitude, east of Mexico.

The waters which flow from the northern slope of the ridge of the isthmus, after their junction, form the river; but those of the southern slope give rise to numberless brooks, which run in the direction of the upper lagoon—the Chicapa and Juchitan—these latter scarcely deserving the name of rivers. They are formed by the union of several brooks, and both disappear during the dry season; for the bed of slate through which they run, before reaching the plain, absorbs their scanty waters. The Chicapa generally disappears by the month of March, about two leagues before reaching the tavern of that name, by which it passes on its way to the lagoon. The Juchitan is absorbed before reaching that spot.

The Ostuta river is formed of the waters descending from the slopes more to the eastward. It empties into the creek which runs in the direction of Fonalá—those to the westward flow into the Tehuantepec.

Both these rivers are too distant from the Coatzacoalco and the more accessible part of the Sierra, to be employed for the desired communication, and both are dry a short time before the commencement of the rainy season. The Chicapa, which is the largest river next to these, takes its source in a wilderness east of Santa Miguel Chimalapa.

A brook, called, if I am not mistaken, the Munesa, by Don Tadeo Ortiz, passes by San Miguel and unites with the Chicapa in that village. Its contiguity to those which, north of the Chicapa, run in a northwesterly direction to form the Alaman, would considerably facilitate the construction of a navigable canal, for they are only half a league apart, and in that place the Sierra Madre is but moderately high; but the scantiness of their waters renders it altogether impossible to effect a communication in this way.

During the greater part of the year, the current is not even nine square feet in its transverse section. We have already seen that the Chicapa is dry during a third part of the year three leagues below San Miguel. Nor are these the only difficulties to be met; another is experienced in the nature of the soil, which is of slate,

absorbing the waters through its innumerable openings. The canal would require moreover numerous locks, there being from San Miguel to the Venta, (tavern,) in a distance of only three short leagues, a difference of level of above seventy *varas*, and almost as many more in double that distance, from the commencement of the plain to the lagoons, not including in this estimate the relative difference of level between San Miguel and the brooks on the other side of the Sierra.

The neighborhood of Chivela and Petapa does not afford better facilities: on the contrary, the waters in those places are still more scanty and farther apart, and the Sierra is higher about Petapa. Neither can any place be found in which large reservoirs could be established to supply the canal with water. As this place is on the very summit of the ridge, the slopes to the valleys are very rapid; the valleys are narrow and form too large an angle. Finally, the soil being of slate, the water is soon absorbed; it is owing to this circumstance, that neither lakes nor ponds are here to be found.

The Coatzacoalco itself would be the only available medium for obtaining in any season a sufficient quantity of water to form a canal, which might be made to connect both seas. The difference of level between the environs of Santa Maria Chimalapa and those of San Miguel is so insignificant, that however great the error in the barometer may have been, some place may reasonably be expected to exist to the east, not far from Santa Maria, whence the waters could be conducted as high as San Miguel.

These localities are eight or nine leagues distant from each other, and the intervening space is intersected by three valleys, almost parallel to the ridge. The first of them, traversed by the Milagro river, is half a league from Santa Maria, and the channel of the river, in the place where the road crosses it, is about twenty-seven *varas* lower than San Miguel. An eminence two hundred *varas* above the valley, and a league and a half in breadth, separates it from the Iscualapa. The second valley traversed by the rivers Iscualapa and Iscualapilla, which join at a short distance before emptying into the Coatzacoalco, is separated from the first by the mountains already mentioned. Its elevation by the Santa Maria road seems to be greater than that of San Miguel by twenty-five *varas*, according to the barometrical observation. From the Iscualapa river the soil gradually rises as high as the mountains, forming the crest of the ridge north of San Miguel. This valley is about half a league wide, and the soil somewhat beyond these rivers rises gently to form the third valley, which is about two leagues wide and a hundred *varas* higher than San Miguel. It is separated from the second valley by an eminence of very slow declivity, and from San Miguel by the crest of the ridge itself. Several brooks run through it, uniting ultimately with the Alaman. Were it not for the wide and lofty hills, placed as a barrier between the Coatzacoalco and the Milagro, and between the latter and the Iscualapa, the elevation of the waters could be easily accomplished. The only obstacles to oppose it would be the slate formation of the soil, and the considerable inequality of the ground in the vicinity

of the village. The enterprise is a gigantic one, and it is doubtful whether the advantages to be derived from it would be a compensation for its cost. A more correct idea can be formed of it by the adjoining tables, as they show the result of the barometrical observations.

After having demonstrated the great difficulties which oppose the construction of a navigable canal through the isthmus, the only available expedient to be adopted is that of a carriage road which would unite the Coatzacoalco river to the lagoons on the south coast. This road I consider both easy and advantageous.

After rendering the Coatzacoalco navigable as far as its confluence with the Alaman, a road might thence be so run along the eastern borders of the latter, the Malaguesa and the Almalaya, as far as the Chivela; having, however, to overcome the obstacles presented by hills of an average height which border the river. But one bridge of any importance would be required for crossing the rivulet, which descends to the north of San Miguel, and receives in its passage that of the Hacienda de Tarifa. It runs through a soil which is gradually depressed until it reaches a perfect plain in the neighborhood of Chivela. There is a difference of ten leagues between the confluence of these rivers and the Hacienda. Not far from the latter is a spot at which we arrive by a slow ascelivity; the crest of the ridge can be crossed at this place, whence the descent immediately begins. After following the sinuous slopes of the ridge for four leagues, we reach the plain. The form there assumed by the extending branches of the Sierra Madre offers great facilities for the easy and gradual declivity of the road before reaching the plain; the difference of level would be two hundred and fifty *varas*, at most, in a distance of four leagues. There are five brooks among these hills, which form as many valleys; they are inconsiderable at times, except during the rainy season, and with the exception of one, are probably dry during the greater part of the year.

Finally, a plain six leagues in breadth, formed of a soil generally sandy, and at times muddy during the rainy season, would facilitate the carrying of a road in a straight line to a wharf situated on the borders of the upper lagoon, whence flatboats might extend the communication to the village of San Dionisio, on the lower lagoon. A port could there be selected for the vessels engaged in the coasting trade.

Possibly it might not be very expensive to excavate a haven on the opposite side of the bar of Santa Ferera for vessels drawing twenty and more feet of water, and also to deepen the principal entrance, or rather to form a canal through that tongue of land, about one fourth of a league wide and a few feet high, which is situated west of it. Its preservation might be somewhat expensive, for the sands washed into these lagoons by the rivers descending from the Sierra Madre, principally the Chicapa and Juchitan, are carried to the sea by a strong current, visible in the Barra de Santa Ferera. They have elevated the bottom, and have formed not only the tongue of land which divides the upper lagoon

from the creek of Filema, but also that which separates the latter from the ocean.

Lastly, if the small harbor situated to the westward, close to the mouth of the Tehuantepec river, which, on account of the flooding of the latter and the want of a vessel to go out to sea, I was prevented from reconnoitering, should be found better adapted for the anchoring large vessels, it would be easy to make an opening from the upper of lagoon, at Filema, across the sandy neck of land which divides them, and from Filema construct a short canal to the mouth of the Tehuantepec, south of the hills of Huilotepec.

It was in this harbor that Cortes launched and equipped the first vessel commissioned to explore the coast of the South sea. In some ancient maps it is called Bara de la Ventura, a name no longer known to the inhabitants. The reason why it is not mentioned in other maps is because the Tehuantepec has often shifted its mouth, flowing sometimes through the Filema creek, below Huilotepec; it left that channel eighteen years ago again to flow into the sea. During the flood of the present year, some portion of its waters reached Filema as formerly through this passage. This, of itself, is a sufficient proof of the scarcity of its waters at other times than in the season of the floods.

The excessive rains during the present year, in places in which they are generally slight, prevented me from surveying the most convenient spot on the borders of the upper lagoon, to which the road might be directed. That such a place must exist between the mouths of the Juchitan and the Chicapa.

The project which we have developed, might afford us some consolation for the difficulties to be encountered in the construction of a navigable canal across the isthmus. According to it, the Coatzacoalco might be ascended forty leagues; then a railroad might be constructed of but twenty-two leagues, probably less, for it would be more direct, and the communication renewed by water to the anchorage of large vessels. It would lower the freight of the merchandise of Europe and Asia, augment its importation by our coasts, and facilitate in return, the exportation of the produce of the States, bordering on the South sea. In fine, by means of this route, the fertility of the isthmus of Tehuantepec, described with so much accuracy by Don Tadeo Ortiz, of whose description we avoid a repetition, would be rendered available for the production of many more articles than it now yields. The population would increase with the means of living, and with the greater value of the articles newly raised; the produce would increase in the same ratio as the population, and with the addition of the agricultural surplus of the equatorial region, that favored territory would arrive at a degree of prosperity advantageous to the whole nation, and which, notwithstanding its natural advantages, it has hitherto been incapable of attaining.

I should here remark, that, although the northern coast of the isthmus is, in my opinion, as liable as the remainder of the gulf to the endemic diseases experienced by the natives during the summer and fall, and to the epidemics which prevail among foreigners and

new settlers, the upper part of the Coatzacoalco, from the confluence of the rivers Sarabia, Chichicovi, Petapa and the Chimalapa on the slopes of the Sierra Madre, the plains south of the latter, and almost the whole extent of the shores of the South sea, are extremely salubrious during the whole year, and free from those diseases which are common even in other sections of the borders of the South sea.

To the elevation of the table land, on which the villages referred to are situated, and to the dryness of the air of Tehuantepec and the adjoining coast, even during the rainy season, should these results be principally attributed; and, although the passage of strangers may hereafter develop the yellow fever on the northern coast, that territory will be still favored by the exemption on the southern shores from those endemic complaints, to which all persons, including the natives and acclimated persons, are always exposed.

The astronomical observations have been limited to those made with a sextant and artificial horizon, and an acromatic telescope of fifty inches (forty-six Spanish) focus. I might, however, have been able to give, with some confidence, the position of all the places visited by us, had the weather been favorable. But we arrived on the Coatzacoalco precisely in the beginning of the rainy season, and the clouded condition of the weather for some days previous, and the fogs in the latter part of the summer, gave us but few opportunities for our observations. The sun was often visible at noon, but its elevation exceeded the range (altura) of the sextant with the artificial horizon; from which circumstances our observations were restricted to the sea coast. Notwithstanding these difficulties, the latitudes of the following places have been determined:

El Paso de Sarabia, (not very reliable on account of the weather)	17	deg.	11	min.	25	sec.
Petapa	16	"	49	"	00	"
San Miguel Chimalapa	16	"	42	"	42	"
Santa Maria Chimalapa	16	"	55	"	30	"
Venta de Chicapa, (the Hacienda,)	16	"	35	"	16	"
Juchitan	16	"	22	"	53	"
Chihuatan	16	"	33	"	54	"
Tehuantepec	16	"	20	"	10	"
San Mateo del Mar	16	"	11	"	33	"
Santa Maria del Mar	16	"	12	"	28	"
The coast south of the village of San Mateo	16	"	10	"	49	"
The coast south of the village of Santa Maria	16	"	11	"	48	"

On the 15th of June we succeeded in observing the emersion of the second satellite of Jupiter, which took place at 8 o'clock, 7′ and 56″ 1, according to a seconds watch of Barraud, regulated on the preceding morning to the elevation of the sun, and rectified on the following day by other absolute altitudes of the same; which gives 29′ 48″ 9, in time, and 97° 27′ 13″ 5, longitude west of Paris; or 0° 15′ 53″ 1, in time, and 3° 58′ 16″, longitude east of Mexico.

The want of a chronometer prevented us from deducing by comparison from this longitude that of other places; and the state of the weather, and the contiguity of Jupiter to the sun, concealed other eclipses of its satellites; nor were we enabled to observe any other occultations of stars.

In the charts which have been drawn, the same latitude and longitude have been given to the Coatzacoalco which of late have been been assigned to it by the hydrographic department of Madrid.

The longitude given to the Paso de Sarabia is that which resulted from the observations of bearings by compass, taken in the river, to ascertain its course; and to the remaining places that which has been deduced from the distances run, having in view the latitude observed.

Owing to my very limited information in geology, and to the want of aid, nothing has been effected in that department, except to collect the principal characteristic specimens* of the country, and the rocks which I have already presented.

Some remarks on the geological formation of the soil are scattered throughout this report.

The licentiate, Don Emeterio Pineda, had charge of the section of botany, and he has acquitted himself with indefatigable assiduity. Several collections of plants, and various specimens of seeds and woods, have been forwarded to the government. I will only add, that we have seen the pine and oak trees two hundred and fifty *varas* above the level of the sea, near San Miguel Chimalapa, on the borders of the Coatzacoalco, near Santa Maria Chimalapa; and in some places situated on the head waters of this river. We also saw the oak almost in the same level, between Jaltipa and Chinameca, in the lower part of the Coatzacoalco.

The study or investigation in other departments of natural history would have required the undivided supervision of a professional man. My attention has necessarily been diverted from this subject, on account of more pressing and absorbing occupations.

The barometrical observations are not completely accurate. The only barometer in the possession of the commission I constructed myself, and we are inclined to suspect that it imbibed a small quantity of air during the journey. This circumstance may have influenced our calculations of the altitudes of the places which we surveyed in their relation to the level of the sea, though not their relative elevation—so far at least as the more elevated ones are concerned. However, when making these calculations, we have endeavored to correct the inaccuracies of the barometer by the subsequent observations made at Tehuantepec, previous to and after the exclusion of the air from the tube by the ebullition of the quicksilver.

The above mentioned tube was broken, at the moment of departure for a new excursion from Tehuantepec, and by this deplorable accident we were deprived of its aid for the remainder of the expedition.

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* These specimens are now in the National Museum of Mexico.

The following are the barometrical altitudes determined before this accident:

	Altitudes above the level of the sea.	
	In metres.	In varas.
Paso de Sarabia, on the Coatzacoalco river....	45.0	53.8
Banks of the Sarabia, on the road to Chichicovi	79.4	95.0
San Juan Chichicovi.....	264.8	316.8
Santa Maria Petapa.....	228.17	273.5
Hacienda de la Chivela.....	240.8	288.1
The highest point on the road from Tarifa to San Miguel.....	357.6	427.7
San Miguel Chimalapa.....	172.8	206.7
Brook called Munosa or San Miguel.....	156.9	187.7
Altitudes of places North of San Miguel.		
Pieora del Lagarto.....	172.8	206.7
Valley with a torrent.....	151.2	180.8
Table land half way of the Cuesta Blanca.....	219.1	262 1
Summit of Cuesta Blanca.....	275.1	329.0
Next elevated spot.....	348.8	417.2
Height near the road leading to the pass of San Miguel.....	398.8	477.0
Mountain pass of San Miguel.....	392.9	470.0
A table land near another pass.....	354.6	424.1
Zapatzcape torrent.....	309.7	370.4
Ditch nearly dry.....	315.1	377.0
Next height.....	366.9	438.9
Another brook with little water.....	353.1	422.4
Another height ending in a table land.....	405.9	485.7
Brook, name unknown.....	371.3	444.1
Another very short brook, before reaching the Copadia.....	384.3	459.8
Rancho de la Copadia.....	401.6	480.7
Cerro Pelado (Bare mountain).....	615.3	736.1
First brook, running to the left on the road to Santa Maria Chimalapa.....	324.7	388.5
Another brook, which is crossed five times....	250.3	299.5
Isculapa river.....	196.5	235.1
Rancho del Chocolate.....	357.2	427.4
Rio Milagro.....	149.5	178.8
Santa Maria Chimalapa, on the square.....	285.8	341.8
The loftiest spot on the road between Santa Maria and the Coatzacoalco.....	321.8	385.0
Coatzacoalco river, three to the east of Santa Maria Chimalapa.....	160.1	191.5
Plain of the Venta de Chicapa, on leaving the woods coming from San Miguel Chimalapa..	111.6	133.3
Hacienda de la Venta de Chicapa.....	54.6	65.3
Juchitan.....	30.5	30.4
Tenuantepec.....	40.8	48.8

Project of a canal to connect the Atlantic and Pacific oceans across the isthmus of Panama, by Napoleon Garella, engineer-in-chief of the royal corps of miners.

CHAPTER I.

From the year 1513, in which Nuñes de Balboa discovered the Pacific ocean, those daring and indefatigable navigators sent by Spain tothe New World, whose innumerable discoveries enrich geography, ardently sought a passage or communication between the Atlantic and Pacific oceans across that long and narrow neck of land which joins North and South America, the extent of which was neither known nor suspected; but all their efforts were vain, and as early as 1525, the non-existence of a passage from the Gulf of Uraba to Florida was determined, in consequence of the reconnaissances made by Columbus, Cortes, Gil Gonzales Davila, Francis Fernandez de Cordova, Alonzo Alvarez de Pineda, and others.

Having lost all hopes of effecting this object, Spain diverted her attention to the establishment of an easy communication between the two seas, which might abridge and facilitate the voyage to the Land of Spices, and supply the want of a natural passage; this was the constant object of the Spanish navigators of that period, and we are indebted to it for the discovery of the strait of Magellan in 1520. In the same year Cortes pointed out, as suitable for that communication, the Guazacoalco river and isthmus of Tehuantepec, in Mexico; in 1524, Adres de Cerneda and Gil Gonzales Davila, who commanded a squadron for the purpose of making discoveries in the South seas, announced the existence of an inland sea of sweet water, only three leagues from the coasts, in 13 degrees latitude.—(Voyages and discoveries of the Spaniards, Navarrete, vol. IV., Madrid, 1837.) This sea was said to augment and decrease alternately, and was thought to communicate with the North sea. If this outlet to the North sea really existed, the nature of the country they had to cross in order to reach the South sea, would permit of an easy communication which would shorten the voyage from Spain to the Land of Spices. Having this object in view, several examinations were made on this spot, though, as it seems, with unsatisfactory results. It is well known, adds Navarrete, that the exploration made some years later, by order of Philip II., by Bautista Antoneli, ended in the abandonment of this plan, on account of the numberless difficulties attending its execution. The project of facilitating the communication of the two oceans by means of the isthmus of *Tehuantepec*, through which it was affirmed that the inhabitants of New Spain transported their merchandise in barges from one sea to the other, was viewed in the same light. In all these explorations, the isthmus of Panama was not forgotten: it appears to have been considered the most practicable point for establishing a communication between the two oceans. The river *de los Lagartos* (alligator, now *Chagres*) was ex-

plored in 1527, by Captain Hernando de la Serna and by the pilot, *Pedro Corzo*, who ascertained that it was navigable for vessels 12 leagues from its mouth, and further up for barges and canoes, which could ascend it by means of towing them from the banks. Finally, a good carriage road was also found to be practicable, between the Chagres river and the point of embarkation at *Panama*, on the South sea. However, it does not appear that these explorations had any other object than the establishment of a good route across the isthmus. By a royal decree, issued at Medina del Campo, on the 12th of March, 1532, by the empress queen, consort of Charles V., it was ordained to reconnoitre the worst parts of the road from *Nombre de Dios* to *Panama*, (on which line the construction of a canal was not deemed practicable,) to take measures for making the *Chagres* river navigable to the nearest point to Panama, and thence to open a carriage road. Notwithstanding, the emperor, Charles V., when he confirmed this decree at Toledo, the 20th February, 1534, sent another to the governor of Costa Firme, commanding him to have the space between the Chagres river and the South sea surveyed by experienced men, to report the result, and to submit the best and most convenient means of effecting the communication of this sea with the navigable limits of the river, and to make a statement of the difficulties to be met with in its execution from the difference in the tides as well as from the inequality of the soil. It may be seen that this decree referred to a navigable communication; but is it to be wondered that the command of Charles V. produced no result, when we see that the governor of the province, *Pascual Andagoya*, replying that such a project could have been suggested but by a man of limited capacity, and totally unacquainted with the country, and that no prince on earth, however powerful he might be, was capable of forming the junction of both seas, even with the aid of the inhabitants of this continent, nor of defraying the expenses required for such an undertaking?

At all events, these splendid projects were abandoned as soon as the vast genius and powerful hand who conceived them had disappeared, and the throne of Spain became the inheritance of feeble and ill-advised princes, who seemed determined to stifle every idea of grandeur and thwart every project which might give rise in America to the idea of independence.

Some attempts were subsequently made, however, as well as surveys and physical observations, on the tides of both seas, but to no purpose. This is the opinion entertained at that period relative to these projects. The jesuit *José de Acosta*, in a Natural and Moral History of the Indies, published in Seville in 1590, said on this subject: "Some persons have spoken of cutting that intervening space, six leagues in length, to connect the two seas, so as to facilitate the voyage to Peru. To effect that object, the eighteen leagues of land which separate *Nombre de Dios* from Panama would require more labor and expense than the voyage by sea of two thousand three hundred leagues. There are some who object to this project that it would be drowning the earth; meaning by this that one sea

is lower than the other, as is seen in the history of ancient times, that a similar obstacle caused the abandonment of the junction of the Red sea with the Nile. As to me, I hold this as a vain endeavor, even should that obstacle not exist, which I do not deem certain; but, in my opinion, *it is above any human power to destroy that powerful and impenetrable barrier of very hard mountains and rocks, which God placed between the two seas, and which suffices to restrain their fury.*"

These first explorations had then no result. The Spaniards were satisfied, for the transportation of the treasures which they drew from Peru, with a frightful road from *Panama* to Porto Bello almost in a straight line, passing over the mountains, descending into the valleys, often availing themselves of the bed of rivers, which rendered it impracticable during a part of the year.*

Some merchandise which came by the Chagres river was carried up the *Cruces*, and thence to Panama on mules by a bad track, hardly deserving the appellation of road; it is the route pursued by travellers and for transportation of the few articles which cross the isthmus. These imperfect and superficial researches, made shortly after the discovery of the Pacific ocean, had, notwithstanding, the result of causing the reconnaissance of three points on which a means of communication might possibly be established. These three points, Panama, Nicaragua, and Tehuantepec, were also pointed out or rather referred to by *Lopez de Gomara*, in a History of the Indies, written in 1551; and what is very remarkable, these three points are those which have attracted more attention of late, and are the only ones where, from all the observations which have been made, the construction of a canal can be attempted.

For two centuries and a half the idea of joining the two oceans by a navigable route seemed to be completely forgotten. However, towards the close of the last century the old project of joining the Guazacoalco to the port of Tehuantepec, in Mexico, was revived, but no real or reliable work was undertaken, and if it was, no traces of it remain, it soon being viewed with the same indifference as formerly.

Mr. Humboldt examined this great question during his travels in North and South America in the beginning of this century, and published on his return the result of his own observations and of the information he was enabled to acquire. He marked nine points as convenient for establishing a communication by water between the two oceans, including therein Chagres, Nicaragua, and Tehuantepec, already mentioned.

These points, situated in the three different states of New Grenada, Central America, and Mexico, now claim the advantages to be derived from the construction of a canal, although until of late no real and efficient labors of practical utility had been undertaken

* I have followed this road in the month of May, 1846. In some places remains of a pavement are to be seen below a metre in width, and it can be easily remarked that it has never been wider. For some hours I bordered the bed of the rivers *Pequeno* and *Boqueron*: in certain places, although mounted on a tall mule, the water was above my knee.

on any one of them, with the exception of Chagres, where an English officer, *Mr. Lloyd*, made, in 1829, by order of *Bolivar*, then President of the republic of Columbia, a survey to ascertain the relative level of both oceans; but this survey, made partly on the old route from Panama to Porto Bello, and partly on the Chagres river, was but a slight preliminary of the works required for the running, and produced no other result, regarded in this light, than that to establish the difference of level between the two oceans, the distance from Panama to Chagres, and the height of the loftiest point of the road taken by Mr. Lloyd. It does not mark, as may have been supposed, the division of the waters, as might be presumed were the road thoroughly surveyed. This fact I have been able to ascertain when surveying the road from Panama to Porto Bello. The remainder of the labors of Mr. Lloyd had not that positive character required for works of this kind, being based on observations made without instruments. It was but a superficial reconnaissance, though executed with care, useful only as a guide to those who might pursue the same course.

The Franco Grenadian Company found matters in this state when the government of New Grenada granted it, in 1838, the privilege of a communication between the two oceans by Panama. After being engaged for several years in making explorations, this company, represented in France by M. M. Salomon, forwarded its results to the French government. They were considered so surprising that the government came to the conclusion of sending one of its officers to the spot to study the subject; and it was in consequence of this decision that I received, in September of 1843, from M. Guizot, Minister of Foreign Affairs, an order to proceed to Panama to study the question of the junction of both seas by cutting through the isthmus, and to find a practical solution to it, not only as regarded the possibility of undertaking a canal, but with regard to obstacles to be overcome, the means of effecting it, and the expenses required for such an enterprise.

Mr. Courtines, director of bridges and causeways, was assigned to aid me in my labor. He has had the special charge of the levelling between the points and following the line I have traced for him, as well as the drawing of a plan of the route he has undertaken to do of this work.

Before proceeding further, I must publicly acknowledge the very courteous reception and constant aid received at the hands of Col. Pineda, governor of the province of Panama. I am the more bound so to do as this reception was given me in pursuance of orders from the executive of *Bogota*, officially notified of the object of my mission. It shows in what light the government of New Grenada views the advantages which the country would derive from the establishment of a good communication between the two oceans, and the facilities and support it would afford to the company who would embark in its execution.

CHAPTER II.

Nature of the communication to be opened.

Before presenting the results of my labors in the isthmus, it may not be uninteresting to examine what should be the nature of the passage to be opened between the two oceans. It can readily be imagined that public opinion has been strongly enlisted in favor of this project. It is for this reason that I deem it advisable to discuss in a summary manner the advantages attending each of these different routes.

The road from one ocean to the other, across the isthmus of Panama, has long since been in use from Chagres, on the Atlantic, to Panama, on the Pacific. The distance in a straight line is only of 65 kilometres,* but the distance to be run is longer. In order to go from Chagres to Panama, the river Chagres must be ascended in barges as far as the *Gorgona* or *Cruces*, according to the season—a distance of 70 or 78 kilometres. From each of these two points a road commences which, in France, would hardly deserve the name of foot-path, only practicable for horses and beasts of burden.

The road from Cruces to Panama, 26 kilometres in length, is uneven, more craggy, and dry than the other, over which it has the preference in the rainy season. That of Gorgona, 30 kilometres long, comparatively more level, and running through a more clayey road generally, is soon deteriorated by the rains. It is preferable in the dry season, from December to May, but when the rains begin, it becomes muddy, and, in the course of a month, impracticable.

Besides, both these roads are merely foot-paths, formed through the woods, without guidance, by simply felling the trees and throwing in places squared trunks, and, on some inconsiderable brooks, to form bridges almost useless; for when these brooks swell with the rains, and they could be advantageously used, their passage is attended with danger. The floor becomes so slippery that it would be imprudent to venture on them; and, moreover, any attempt of this kind is generally useless in consequence of the mules refusing, with their natural instinct, to cross them. It seems, however, that the road from Cruces to Panama was formerly paved at least for a great length; but the pavement having been long without repair, is now injured almost in all places, adding a new obstacle to beasts of burden. In this state of the road, and in the most favorable season, to wit, February, March, and April, a man, well mounted, can make the distance from Panama to Cruces, or Gorgona, in four or five hours; in the month of June, he requires from eight no nine. Beasts of burden will require in all seasons from

* According to the general measurement which I have recently made between these two points, the distance in a direct line from the Cathedral of Panama to the Pavillion of the fort of Chagres, (Cartillo de San Lorenzo,) situated at the entrance of the port on the mouth of the river, is 65,470 metres.

eight to ten hours. The ascent of the river Chagres, as far as the Gorgona, can be made in the dry season in eighteen or twenty hours in a light canoe, only carrying one traveller and some baggage, a pilot, and two rowers; loaded barges require at least three days, and when the river has swollen with the rains, eight and even ten. Therefore, under circumstances the most favorable, it will take twenty-four hours to go from Chagres to Panama, and even so without stopping a single moment: twenty-four hours to make a distance which a footman would walk in twenty hours, a man on horseback in twelve, on a tolerable road; and then the voyage requires an expense of $15 to $20, (75 to 100 francs, about 0f. 50 centimes per kilometer, which is five times more than it would cost in France to travel by the mail post.) The transport of merchandise over these 102 kilometres, separating Chagres from Panama, is made at the cost of $3 50 a package, weighing 100 pounds, or 350 francs per ton of 1,000 kilogrammes—that is to say, 3 francs per ton and per kilometer, ten times the cost of carriage in France.

Having these facts in view, no one could question the advantages which would accrue to the country by the construction of any route which would establish a constant and convenient communication between Chagres and Panama. The opening of a new road is always considered a benefit even in countries like France, possessing many; with far more truth should they be so considered in a country which, like the isthmus, is utterly deficient in them; for the name of road cannot be applied to the *royal route* (*caminos reales*) of New Grenada.

But what advantages would be derived by commerce at large from the establishment of a Macadamized route, or even from a railroad? Europe would feel its effect very slightly, and after a very long time. Who could imagine that French or English merchants would choose the way of the isthmus to send their goods to Valparaiso, or even to Lima, because the construction of a road would lower the freights across the isthmus, and reduce the time for crossing to two or three days, so long as they would have the certainty of transhipping their merchandise four times before reaching their destination? In the present state of things, the bar situated at the entrance of the Chagres river has only four metres water, which only permits the entrance into the port of vessels drawing at most 3m.50 water—consequently, of less than 200 tons burthen—too small to cross the Atlantic without danger. A vessel chartered in Europe would be compelled to deposite her cargo in one of the ports of the Gulf of Mexico—at the Antilles or at Carthagena—thence to be transhipped to a small vessel, in order to enter the port of Chagres. At Chagres, a new transhipment is required into the canoes which ascend the river as far as the Gorgona, or Cruces; in one of those two places, they must be carried to Panama on mules, and there they are to be taken in small boats to the vessels anchored one or two miles into the bay. And to compensate these inconveniences, the uncertain advantage of a

shorter route would not be attained; for, once at Panama, this merchandise must wait for a vessel to take it to its destination.

These difficulties might ultimately be partly removed; but, at all events, a transhipment at least would be required, which will always vitiate this means of overland communication, not to be compensated by the advantages of a doubtful rapidity. These considerations are equally applicable to a railroad and a Macadamized route. I will even assert that it would be a folly to endeavor to establish a railway in a locality in which an ordinary road would be more than sufficient for travel, and where the increase in velocity of a few hours, nay of a few days, on a voyage of several months, would be too insignificant to draw a general circulation.*

That which commerce at large stands in need of is a communication of such a nature that a vessel sailing from Europe or the United States, to *Valparaiso*, *Lima*, *Acapulco*, or *Canton*, should be enabled, without transhipping, to cross the isthmus to its destination. As Mr. Michel Chevalier has very justly remarked in a recent work, "all communications requiring a transhipment would be to commerce at large as non-existing." Anything which may be done short of this will have but a local merit, and then the best that can be done will be a Macadamized road, as the cheapest and of readiest execution; but in this case, Europe would not be obliged to interfere, and, above all, to contribute to the expense.

In my opinion, then, there are but two things to be done on the isthmus. As far as commerce at large is concerned, a canal freely communicating with both oceans, and of such dimensions as to admit the largest merchantmen that navigate the ocean or even circumnavigate the globe. As far as local interest is concerned, a Macadamized road is required which would not exclude the future construction of a great oceanic canal, nor that of more perfect local communications, such as the railway or a small canal, when the development of intercourse would render their execution necessary. Besides these means, only one-half of incomplete measures could be adopted, which would defeat one of the ends, augmenting to no purpose the expenses without ever attaining the other.

Having been commissioned to the spot by the French government, whose interests are those of commerce at large, and who cannot evidently contribute to the work, but so long as its interest would be engaged in it, I have naturally dwelt principally on the idea of a great maritime canal, and it is also to this object that I have directed all my labors.

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* According to official information communicated by the custom-house at Panama, the amount of merchandise which has crossed the isthmus, from the 1st of September, 1843, to the 31st of August, 1843, is 7,932 bales, of 50 kilogrammes, to wit:

For consumption	4,483 or 224 tons.
For transit	3,449 or 172 "
Total	7,932 or 396 "

The transit nearly corresponds, as may be seen, to the interior consumption. The comparison of the numbers fully shows that the transit does not constitute by itself a branch of trade, but is merely employed to obtain the return cargoes for those vessels which have brought the merchandise required for consumption.

CHAPTER III.

Topographical configuration of the isthmus of Panama.

That remarkable isthmus, which, connecting North and South America, extends between the Gulf of Mexico and the Pacific ocean, a distance of 2,300 kilometres in a direction from west-northwest to east-southeast, presents, in that enormous length, a variable breadth. From the mouth of the Guasacoalco, where it connects with North America, presenting a width of 220 kilometres, it gradually decreases, with the exception of the enlargements at Yucatan and Central America, as far as its other extremity, near the Gulf of Darien, where it connects with South America. It is in the vicinity of this part, where it has more particularly received the appellation of the isthmus of Panama, that it presents its least breadth.

At Panama itself, between Panama and Chagres, the distance in a straight line is but of 65,470 metres; from the mouth of the Caimito on the Pacific ocean 22,000 metres; west of Panama, to the mouth of the Chagres river on the Atlantic ocean, the distance is only of 58 kilometres; but the minimum in breadth seems to be somewhat more to the east, between the bay of Mandingo or San Blas on the sea of the Antilles, and the coast of the Pacific ocean near the mouth of the Rio Chepo. According to the maps it appears to be of but 50 kilometres.

The great chain of mountains running over the whole length of North and South America, almost in a direction from north to south, from the frozen sea of the north pole to Cape Horn, which in North America forms the Rocky Mountains and in South America the cordillera of the Andes, presents, on this length of 14,000 kilometres, a considerable elevation, elevated peaks, unsurpassed in height but by the loftiest summits of the Himmalaya mountains, and even vast table lands, as those of Mexico, more elevated than the highest mountains in the interior of France. This chain extends without interruption over the whole length of the isthmus, but there, in proportion as the breadth of the land is considerably diminished, so the summit of the chain decreases in elevation and offers some depreciations, the elevations of which, above the level of the ocean, is smaller than that of some canals with summit levels constructed in Europe. One of these depressions of the ridge is seen in the vicinity of Panama, not where the isthmus is narrowest, but a little to the west in a place in which it is even more restricted than at Panama.

If we examine the configuration of the isthmus, in its direction from west to east, it will be seen that, on leaving the State of Costa Rica (Central America) to enter into the Province of Veragua, (New Grenada,) eighty-five degrees west longitude, and three degrees west of Panama, the central crest which divides the slopes on both oceans has a considerable elevation, in relation at least to the small extent of its base: that it extends with the same elevation for some distance, and that it then seems to cease abruptly in

the arduous and craggy peaks of the Trinity, (Cerro de la Trinidad,) situated fifty kilometres west of Panama, the height of which may be calculated in 1,200 or 1,500 metres. From this place commences that depression of which I have already spoken, prolonged for a distance of 40,000 metres to the hills of Los Ormigueros, not far from the roads from Panama to Cruces and the Gorgona. The chain then gradually increases in height until it resumes, opposite Porto Bello and in the Gulf of San Blas, its primitive elevation. On this extent, several passes are seen from one slope to the other, the height of which, generally inconsiderable, varies from 130 to 160 metres, between which the crest of the ridge towers gently, and forms round hills, (not peaks, or lofty rocks.) This depreciation of the central chain is then one of the first and easiest observations made by an explorer; on that account it has been noticed by all those who have surveyed the isthmus. Mr. Lloyd points it out for the site of a canal; and it is there also that Mr. Morel, agent of the Company Salomon, bases his project; it is evidently there that the summit level of the maritime communication to be opened between the two oceans is to be found. Unfortunately, those who have hitherto visited the isthmus have judged by approximation of the height of this part of the chain, and from a simple visual observation, made without the aid of instruments—taking, doubtless, as a point of comparison the lofty mountains of La Trinidad, and other considerable heights situated further to the east; those of Cerro de Cabra, which is 492 metres in height, and the Cerro Grande de la Gorgona, which has 310 metres.

Undoubtedly this has given rise to the erroneous opinion, adopted on the authority of some navigators, that the central chain, which unites the elevated table lands of Mexico with the Andes of Peru, was completely interrupted in this place, being separated by a transversal valley, in which all that was left for man to do was the establishing of a navigable communication between the two oceans. Thence also the extraordinary assertion, truly marvellous had it proved true, made by the Company Salomon, that this depreciation of the chain presented a passage situated only 11.28 metres above the average level of the sea at Panama, it being necessarily the point selected by the company for the passage of the summit level which it projected.

Three principal streams take their rise in the Cerro de la Trinidad; the most considerable of them, the Caimito, runs parallel to the central chain in a northeasterly direction, then turns to the right towards the southeast—afterwards to the south, and empties into the Pacific ocean, not far from the village of La Chorrera, 22 kilometres west of Panama, after having received the waters of the Bernardino, its principal affluent.

The two other streams, which flow towards the Atlantic ocean, are the Caño Quebrado and the Rio Trinidad; both rise almost at the same place, and separate as they flow—the former runs parallel to the central chain and the Caimito, the latter runs almost due north; both flow into the Chagres, which descends from the elevated mountains situated east of the line joining Panama and Porto

Bello, and, flowing first from southwest to west, diverges towards the northwest, somewhat before the confluence of the Cano Quebrado, and empties into the Atlantic ocean in the port of Chagres, twenty-seven kilometers below the confluence of the Rio Trinidad. The Rio Trinidad has its mouth 15,000 metres (in the straight line) below that of the Cano Quebrado; and in the triangular space enclosed by these two streams, that law of nature which, in the whole of America, has placed the summits which separate the waters running into the two oceans nearest to the western coast, seems to have been preserved. The spur, generally of little elevation, which separates the basin of the Trindad from those of the Cano Quebrado and the Chagres, borders constantly these two rivers, and this has considerably augmented the former at the expense of the Cano Quebrado, the stream of which is less considerable. The large space which separates the bed of the Trinidad from the base of the spur is occupied by vast plains in the midst of which some round hills rear their heads. Here no no rivers are seen, which, from its extent, might have been expected; but marshes, and even deep lakes, which connect with the Rio Trinidad by small natural canals, called *esteros*, (it is the name given to an inlet which is only filled at high tide, seeming, by this circumstance, to characterize a canal with much water and a slow current. In these plains is seen the lake *Vino Tinto*, more than a league in diameter, surveyed by M. Morel; as also the marshes of Agua Clara, near the mouth of the river, having, as I have been assured, 12 metres (15 varas) water in some parts.

Besides these streams, another is found on the slope of the Pacific ocean, running directly into the sea. It is the Rio Grande, situated between the Caimito and Panama; its mouth is 2,000 metres west of the city. It is an inconsiderable rivulet; the upper part of it is completely dry during a part of the year; but it resembles the other affluents of the Pacific ocean; in the lower part having little declivity and much breadth, so that the tide is perceptible for a long distance, and form thereby real inlets, (*esteros*) with a depth from 8 to 10 metres, and sometimes more; their navigation is easy, but only possible at high tide, closing at the point in which the tide is no longer felt. To this circumstance the Rio Grande owes its name, although being a small stream. Near the Rio Grande is another gutter emptying its waters directly into the sea, called the Rio Farfan; its bed is wide and deep at the mouth, and is only separated at this point from the Rio Grande by a hill, which the strong tides force it to obviate by crossing the swamp of Albino, on the road from Panama to the Chorrera, mixing the waters of both rivulets.

The circumstance of a want of declivity in the neighborhood of the mouth is much more sensible. On the slope of the North sea, (the Atlantic,) the Chagres, undoubtedly the most important and voluminous of the streams in this part of the isthmus, presents this feature in a forcible manner.

The tide of the Atlantic ocean, which rises but 34 or 40 centimetres, is perceptible to the distance of 28 kilometres from its

mouth, above the confluence of the Trinidad. The Rio Chagres, according to a gauging made at the Gorgona on the 26th of March, 1844, at the period of the lowest waters above the Caño Quebrado and the Rio Trinidad, rolls a minimum volume of water of 19.50 cubic metres per second. It is a little more than the fifth of that of the Seine, in Paris, at its ordinary height, 90 cubic metres; about half of the Garonne, at Toulouse; two-thirds of the Saône, at Saint Jean de Lorne; and once and a half as much as the Loire, at Nevers. It becomes truly an arm of the sea in its lower part; the current sometimes ascending and descending, is there very weak. The width varies from 60 to 100 metres, and its depth, which is 4 or 5 metres on an average, rises in some places to 10 or 12. Hence this river is navigable, although with some difficulties, 30 kilometres from its mouth. Thenceforward it can only be ascended by the aid of poles, owing to the rapidity of the current and the irregularity of its depth. Laden barges ascend, nevertheless, as far as la Gorgona and Cruces; but during the dry season, (the *verano*, from December to June,) barges of larger size are obliged to unload on a beach near the mouth of the Caño Quebrado, and to reship in the smaller ones, which reach Cruces, but with great difficulty. During the rainy season, when there is sufficient depth, the current becomes so rapid that it can only be ascended very slowly, requiring from eight to ten days for a distance of less than 80 kilometres. Besides the Chagres, there are no navigable streams on the isthmus. The Trinidad, above the place in which the tides are perceptible, becomes a torrent, which can only be ascended to a certain distance when it has swollen with the rains, and even then with great difficulty. The Caimito has no depth of water except near its mouth, and, like the Bernardino, cannot be ascended further than tide water. None of those streams can, in my opinion, be made subservient to navigation, excepting in places influenced by the tides; and even in this case peculiar works would be required, at least on the Atlantic side, to oppose the effects of the increase and decrease, which are very strong on this side.

It appears from observations made during my stay at Panama, that the highest tides of the full and new moon of equinox, (6th and 21st of March, 1844,) are of 6 10 metres; the lowest tides of slack water, 2.75 metres. On the Atlantic side they only attain 30 or 40 centimetres. This difference in the level of the water is too insignificant to be noticed in the construction of a canal of communication, otherwise than by taking the level of the lowest tide as the point of departure for the depth to be given to the canal.

The waters running from the main ridge in its point of depression are, therefore, received into two basins—that of the Caimito, on the slope of the Pacific ocean, and that of the Rio Chagres, or rather the Caño Quebrado, in the slope of the Atlantic. I do not mention that of the Rio Trinidad, of which I have spoken above, because its source, contiguous to the Cerro de Trinidad, seemed at too great an elevation there to seek a passage.

The former of these basins, which directly empties into the sea, is bounded on the west by a spur which, starting from the Cerro Trinidad, ends in the village of the Chorrera by round hills of little elevation, and by plains, in the midst of which the Cerro Gordo is seen, a conical mountain, entirely isolated, of about one hundred metres in height. It is separated on the east from the basin of the Rio Grande by an elevated spur which, dividing from the main ridge at the Cerro Calderon, near the Ormigueros, ends in the cliffs of Cerro de Cabra, the most elevated of this part of the isthmus. Its principal affluents are the Rio Bernardino and the Rio Aguacate, which empties into the former. The second basin, that of the Caño Quebrado, which is itself but the principal affluent of the Chagres, embraces almost the same extent of the main ridge; it is limited on the east by a round spur springing from the summit of the Ormigueros.

It is, then, between the two basins of the Caimito and the Caño Quebrado that we should look for a point of passage for a canal of communication between the two oceans; it is in their affluents that the two valleys should be looked for through which the canal is to pass. It is, finally, in the neighborhood of the point where their waters empty into the sea; that is to say, near the mouth of Rio Caimito and the Rio Chagres, that we should look for the point where the canal itself should empty into the sea. The bars formed at the points in which the running waters of the rivers meet the tranquil ones of the sea should, generally speaking, be the places for the tracing or delineation of a grand navigable canal.

The bar at the mouth of the Chagres river has but 4 metres water, a depth by far inferior to that existing in the river itself, which can only admit of vessels drawing 3m.50 water, and even those can only pass it with difficulty, and merely during the fair season. In the centre of the bar is a breaker only 1 metre below the surface of the water, which restricts the passage to about 200 metres. This bar leans on the east against the high rocks on which the castle of San Lorenzo is built, the river running below, and is connected by the west to a very extended beach bordering the isthmus for a great distance on the Atlantic side. It will be seen that in this state of things such an entrance would be insufficient for an oceanic canal as that we now have in view—a canal which should admit vessels of the largest burthen, drawing at least 7 metres in smooth water. Certainly it would not be impossible to remedy, at least momentarily, the inconvenience, but the uncertainty of the results of those works, made at the mouth of rivers even more considerable than the Chagres, and confirmed by experience, when banks are to be removed, should warn us against employing such means, except when it would be impossible to find a more convenient entry; but nature itself seems to have provided for it.

Eight thousand metres east of the river Chagres is the large and vast bay of the Limon, 4,000 metres in width by 6,000 in length. The centre is very deep, having 6 fathoms (10 metres) water. This bay is only separated from the river by lands for the most part of little elevation, and in some places sufficiently low to admit of the

possibility, nay the practicability, of a canal of communication with the river. Some works could be easily executed, by means of which a vast and safe harbor would be had at the entrance of the canal, in the bay which, opening to the north, is now exposed to the direct action of the north-northeast and northwest winds, almost constantly prevailing in these places.

The difficulties met at the mouth of the Chagres on the Atlantic are still far more serious in that of the Caimito on the Pacific. This mouth is located in the centre of an extended beach, which, in low tide, is perceptible to a distance of about 1,000 metres from the coast. The want of depth is thereby combined with the inconvenience of the sands. The former is of common occurrence over the whole coast, from Caimito to Panama; and in this city, on account of the great difference of level in the sea, the bricks, small vessels of two or three hundred tons burthen, drawing only from 3m.50 to 4 metres water, cannot cast anchor but at a distance of 2,000 metres. The sand bars are also numerous almost through the whole coast, but more particularly so in the bottom of the bays and on the mouth of streams. It is principally between Panama and the Cerros de Cabra that the water is sufficient in depth. This inconvenience is sufficiently indicated by great numbers of islets or keys, seen at a distance from the coast, surrounded by breakers, visible in low tide. The *Venados* islet, among others, which, in high tide, is 1,200 metres from the shore, is connected with it by a bank of rocks bare by the ebb. Their number decreases as we advance towards the west, and they entirely disappear opposite the mouth of the Caimito, leaving entirely free the arm of the sea or inlet which separates it from the islands of *Taboga*, *Taboguilla*, and situated at 11 kilometres from the coast, where excellent anchorage is found for the largest vessels. The coast does not afford in the neighborhood of this region any favorable place for the location of a good haven, with a sufficient depth of water, for here it would be necessary to add to the depth of water required for vessels the elevation of the tide; but fortunately the proximity to the port of Taboga and the almost constant tranquillity of the gulf of Panama, in the bottom of which the Caimito empties itself, would only make it requisite to keep in view, for the location of the entrance of the canal, the depth of water in high tide.

The point on the coast which in my opinion combines all the necessary requisites for this object, is a small bay 350 metres in its mouth and 200 metres deep, situated 4,000 metres east of the mouth of the Caimito, at the foot of the small mountain of *Vaca de Monte*, and which for this reason I have designated under the name of *Ensenada de Vaca de Monte*. It is bordered by rocks, and receives in its bottom a very inconsiderable stream. The depth of water has been found to be of 3 metres on an average at low tide on the 3d of July, 1844, (three days after the full moon,) equivalent at least to 8 metres at high tide; therefore, it would be easy to establish in this place the entrance lock (éclue d'entreé) of a canal, with such a depth of water that vessels might be enabled to enter it at least during the highest tides of slack water, near the first and last quarter

of the moon. The privilege which had been granted to the *Salomon* company for the execution of an inter-oceanic canal, had it as a condition that the canal should terminate precisely at Panama, for this reason: the company had thought fit to end its proposed line at Playa Prieta, (Black beach,) a little to the east of Panama.

I cannot but see this question in another point of view: The interests of the city of Panama are very insignificant when compared to those of the nations concerned in the construction of a great canal through the isthmus. For the establishment of a communication of local interest, executed at the expense and for the benefit of said localities, merely local circumstances should be had in view, such as the gathering of populations on stated points; but in regard to a canal which would doubtless be executed by Europe, and for the sake of her commerce, I have thought it my duty only to weigh the obstacles or natural facilities which the topography of the isthmus can afford, without attending in the least to the actual situation of cities, reserving, however, to propose in the sequel secondary routes to unite them with the canal.

CHAPTER IV.

Geological sketch on the formation of the soil of the isthmus.

The study of the geological composition or formation of the soil to be traversed by a canal, is not less essential than that of its topographical configuration. It is well known that we have often been led into error in consequence of the porosity of the soil. How much in these cases the expenses have been increased by the sinking and crumbling from want of solidity in the soil, or through the interposition of inclined layers of clay, on which it is sometimes impossible to fix the earth above. This circumstance has sometimes produced results of sufficient importance to require a change of route. It has happened in certain canals, that under peculiar circumstances the infiltrations have absorbed within twenty-four hours all the waters of the canal; in others they have endangered the navigation during two-thirds of the year. I have therefore deemed it useful here to state the results of the geological observations which I have been able to make in the numerous explorations required by the researches for the location of a canal.

In the places surveyed by me, embracing a zone of about ten thousand metres in width, and extending from Panama to Chagres, the rocks which constitute the soil are almost constantly overlaid by a vegetable earth, composed of hard argile, sometimes sandy or gravellous, the thickness of which must be considerable, if we are to judge by the abundance and vigor of the vegetation. With very rare exceptions, such as the summits of mountains and the bed of torrents in the vicinity of their source where the declivity is abrupt, the rocks are seldom bare; nevertheless, in places where the dense and elevated forests which cover almost the whole isthmus

are interrupted by some *sabanas* or natural prairies, there is, instead of vegetable earth, a hard clay of a red color, streaked with yellow spots, seen in places far apart. On the highest mountains, the Cerro de Cabra and the Cerro Grande, the rocks are only seen in isolated fragments, sometimes even in considerable blocks, scattered over the argillaceous earth. They generally are amphibolic rocks, greenish, crystalline, and hard, and are sometimes of modified porphyry. Only the *Cerro Tigre*, a conical and isolated mountain 128 metres high, in the centre of the basin of San Bernardino, presents the naked or bare rock of which it is composed—a large mass of porphyry, presenting several varieties more or less modified, without any appearance of stratification.

On the southern slope of the isthmus, which, as will be seen by the adjoining map, is much shorter than the northern slope, the coasts of the Pacific ocean are the most favorable points for the observation of rocks. On all points not occupied by beaches, the rocks are seen bare, and present to the observer an amphibolic soil of the nature of that designated by the generic name of *Trappa*, in compact masses without any stratification.

The low and advanced point on which the city of Panama is built is an exception to this general rule. Between Playa Prieta on the east, and the mouth of the Rio Grande on the west, we find a soil of sandstone, perfectly stratified in extended, and almost horizontal layers, which appear to belong to the formation of transition soil.

The shores of the Atlantic ocean present different characteristics. The strands, which form the greater extent of the shores of the isthmus, cease at the mouth of the river Chagres. Between this point and the bay of Limon, situated 8,000 metres to the northeast, the coast is sufficiently elevated, and formed in some places by precipices 60 or 80 metres high. It is on one of these lofty hills, forming one of the sides of the port of Chagres, that the fort of San Lorenzo is built. Here the nature of the rocks can be more easily observed. It is alternately a fine sandstone and calcareous shell, evidently belonging to the third stage. In the midst of these rocks are again found banks of fossil polypus, which, farther to the west, at Porto Bello, are much more abundant, and were formerly used as freestone. This same composition of the soil embraces all the extent of land situated between the river Chagres and the bay of the Limon, and appears to extend up the river almost as far as the Rio Trinidad.

While ascending the Chagres river above this place, we constantly meet steep banks formed by the hard argillaceous soil which overlays the rocks. Almost in every place where these lay bare they are only a conglomeration of evidently recent formations, composed of a granitic, and porphyric nucleus, proceeding from rocks of ancient formation, which constitute the mountains in the centre of the isthmus, and similar in other respects to the rolled pebbles found at the head waters of the Chagres. These nucleus are agglomerated in a paste of friable sandstone, or rather compact sand, without consistency, of a greyish or greenish color. These rocks are no longer found after we leave the river; a circumstance which

proves that to its waters is owing the transportation of the nucleus of this sort of conglomeration, as also the formation of the sandy rock uniting it.

This is, therefore, a formation altogether distinct, and separated from the rocks constituting the soil of the isthmus, with which it has no relation other than the affinity of its constituent parts.

However, we find again in two points well stratified rocks, evidently solid, and constituting a part of those forming the soil of the isthmus:

1st. Below Vamos-Vamos, between this place and the Estero de Juan Gallego, on the right bank, we meet white rocks of coarse grained limestone, traversed by crystalline and calcareous veins in banks of upwards of a metre thick, with a direction from the south-east to the northwest, plunging about 20 degrees towards the south-west. With these calcareous layers are associated layers of very fine sandstone of a grayish color, in which are interspersed now and then some particles of crystalized lime.

Both these rocks, the former particularly, could, in my opinion, be successfully used for the same purposes as freestone. As regards their geological age, the small space in which they are visible, the impossibility of discovering their direct affinity with the rest of the soil, makes it somewhat difficult to determine them exactly; however, their minerological characteristics, their associations and intermediate positions between the rocks of the third stage and the more ancient rocks of the central mountains, induce me to class them in the middle of the secondary stage.

2d. At Barbacoa, also on the right bank of the river, there is a small steepness, where the rocks are seen naked. They are sandstones of a greyish green, compact, but with fissures; for which reason they could not be used probably as freestones, notwithstanding the fine grain of the paste. They are mixed with coarser sandstone, with grains of quartz, analogous to the grey wacks of the transition soil, with which they might, in my opinion at least, be classed with the more ancient secondary soil.

On following the ascent towards the mountains, another rock is yet seen on the northern slope of the Cerro Grande. It is a white quartzose sandstone, of an average thickness, in slender banks, inclined according to the slope of the mountain, and presenting the characteristics of the sandstones and grey-wacks of the soil of transition. Finally, other rocks are found, which present several varieties of sandstones, and appear to belong to the same formation, in the centre of the mass of mountains, which border the Cerro Grande in the line of route pursued from the source of the Rio Faja to the Gorgona.

With these exceptions, no other rocks are generally seen on the slope of the ridge than the green crystalline very hard amphibolite, of which I have already spoken, disseminated in blocks, more or less thick, in the middle of strong and consistent argile. They even descend on this slope a great deal lower than the last of the points already named; for they are seen again in the beds of the

different branches of the Rio Gigante, in the Loma (mountain) of Palenquilla, as also in that situated below Varro Colorado.

By resuming the preceding observations, we are inclined to admit in the isthmus four very distinct formations:

1st. Porphyric and trap formation, by far the most extended, and which embraces the rocks of all the mountains of the isthmus, from the neighborhood of Panama to the last round hills of the spur of the main ridge at Barro Colorado.

2d. Formation of sandstone and grey-wack, which is seen at Panama itself, and on the slopes of the Cerro Grande, and among which we must probably class the rocks of Barbacoa.

3d. Secondary formation only seen or visible in a single spot, below Vamos Vamos, admitting that the rocks of Barbacoa should be classed with the preceding.

4th. Formation of sandstone and calcareous shell of the third stage.

The most considerable is that of trap and porphyry, which embraces all the soil extending between the Rio Trinidad and the sea on the left bank of the Chagres, and that extending on the right bank to the bay of Limon. The rocks of trap and porphyry are seen here together, as they generally are in other countries in which they are observed. One of the outward characteristics of the soil composed of those rocks is, their assuming the form of round hills, or conical mounds. This is a characteristic of the isthmus.

The masses of the mountain assume round forms, except some consolidated mountains, as the Cerros Tigre, Gordo de la Chorrera, and Sierpe. It should be remarked that the latter are more generally formed of porphyritic rocks, whereas the round masses are composed or formed of rocks of trap, which, on the surface, are seen in blocks of various sizes scattered over an argillaceous soil. These rocks of trap present, on the other hand, a great uniformity. With the exception of the shores of the Pacific ocean, in some places between the mouths of the Caimito and the Rio Grande, they are only seen in fragments, even on the summit of the highest mountain of the isthmus, the Cerro de Cabra. They are of a dark green, with a crystalline structure bearing great analogy to the ophites of the Pyrenees, and surrounded by a thin covering which seems to have undergone a sort of fusion. These same characteristics are found equally in the pebbles washed by the Bernardino, and in the rocks of the Cerro de los Hormigueros, which forms a part of the main ridge; and in those of the mountain of Barro Colorado, and on the borders of the Rio Gigante. It is probable that these rocks can only be found in entire masses at a certain distance from the surface, as on the shores of the Pacific ocean, especially in the centre of the beach of Venados.

The porphyritic rocks afford, on the contrary, a great variety of characteristics, in color as well as consistency, from the compact and hard porphyrys, which generally assume a greenish color, to the argillaceous, the friable, reddish yellow porphyrys, found on the sides of the Cerro Tigre, and near Loma Alta, to the red argile, streaked with yellow, already mentioned, and which should not, I think, be classed among other formations. The com-

pink porphyrys of a greenish color, sometimes of a dark red, afford an excellent hard freestone. It is the only one which is, or rather which has been, used in Panama. On the other hand, the argile is very common throughout the isthmus, and furnishes an excellent material for bricks or potters' earth.

The rocks of this porphyritic and trappean soil present the peculiar characteristic of containing, as a constituent principle, magnetic oxidated iron, and exercise a certain influence on the magnet. On a distance of 1,700 metres of the trigonometric base, which I have measured at the gates of Panama, on the Playa Prieta, and the eastern extremity of which lies on a rock of trap, I have remarked in the magnetic needle a deviation of more than three and a half degrees. The wearing off of these rocks by the constant shock of the sea, and the washing of the argile by the rains, lay bare these ferruginous particles, and produce this black metallic sand to which the Playa Prieta (black beach) owes its name, and which is met in several places of the interior. I am induced to believe, from my own observations and by the presence of a large number of gold mines in the porphyritic soil of America, that it is owing to the washing of these clays by the rains that several rivers of the isthmus roll auriferous sands.

I have described at some length these different soils of trap and porphyry, because, from the large space they occupy, it may be easily seen from this moment that a canal joining the river Chagres with the small bay of Vaca de Monte, already pointed out by me as the one on which the entrance of the canal on the Pacific ocean should be located, must either be excavated in the vegetable soil, or in the rocks of trap, and porphyry and argile, which accompany them. This very extended formation, considering the space to which my observations have been restricted, becomes much less so if a larger space should be embraced. For instance, on the road from Panama to Porto Bello we meet, on the main ridge, rocks of quartz in strong and extended banks. In the river Chagres are seen rolled pebbles of granite and other crystalline rocks, some euphotides, denoting that the mountain in which it rises are of primitive formation. Towards the east, the indented appearance of the steep mountains of la Trinidad incline us to assign it an analogous formation; the porphyric formation would then be limited, at least in this part of the isthmus, to a space of fifty or sixty kilometres in breadth.

I will add, though with the diffidence arising from the limited extent and the rapidity of my observations, however superficial they may necessarily have been, that I think I am enabled to conclude that the soil of trap and porphyry has been lifted up and laid bare subsequent to the formation of the soil of transition, traversing the latter, lifting it up in some places, as on the sides of the Cerro Grande, and even covering it at times with the argillaceous dejections forming the argilophires seen in many remote localities; that the mountains from which the river Chagres flows on the one hand, and the Rio Trinidad on the other, formed before this period the projecting extremities of the two American

continents, or perhaps only of the islands between which a vast strait existed; and that the presence of the porphyrys has filled this strait, placing in its stead a tongue of land, which cannot, it is true, be entirely removed, but through the centre of which it will not be very difficult to cut a navigable route, affording the passage, the secret of which has been vainly sought with so much perseverance by the first conquerors of Mexico.

CHAPTER V.

On the materials for construction afforded by the soil of the isthmus.

After the preceding geological sketch, I deem it advisable to enter into some details on the materials for construction which the soil of the isthmus would afford, although that sketch, notwithstanding its rapidity, seems to me to be no less comprehensive:

1. *The freestone.*—Two qualities are known at present, which have been and are still in occasional use, to wit: those of Panama, and those of Chagres. At Panama, the quarries situated at the distance of two kilometres from the town, near the road to Cruces, furnish porphyric blocks from which beautiful stones are easily cut. It is from these quarries that those stones have been cut which we notice in some buildings at Panama; they have also furnished the stones used for the construction of the walls.

At Chagres, freestones were formerly used in the building of Fort Saint Lorenzo. I have not being able to obtain information respecting the location of the quarries from which these stones have been brought; but, as they are formed of that tertiary sandstone, with fine grain, forming the base of the surrounding soil, some points might certainly be found in which they could be worked to advantage. To these two species, the calcareous stone of Vamos-Vamos could be added. It has a very fine grain, and holds the medium between the other two in regard to hardness. These different quarries are, besides, very well located to facilitate transportation—the one being near the sea and the port of Panama, and the other two on the borders of the river Chagres.

2. Rough stones for common masonry would not be wanting on the isthmus. The amphibolites, too hard for the chisel, would furnish excellent ones; they are common over the whole extent of the isthmus, so that they could be easily procured wherever needed.

3. *Potters' earth.*—The clays of porphyritic formation described above, constitute, as I have already said, an excellent material for bricks. The Spaniards, when they were masters of the isthmus, availed themselves of its peculiar qualities, and succeeded in making very good tiles and bricks, now sought with eagerness upon demolition of ancient buildings. It is true, that bricks and tiles are actually made in some places; but their quality is bad and the price very high, (75 francs per thousand;) for the in-

habitants of this part of New Grenada are unfortunately very backward in all sorts of manufactures; besides digging up the old bricks made by the Spaniards, the inhabitants of the isthmus even import them from the United States. I have seen materials of this description used in a building at Chagres. The same results as were produced by the Spaniards in former times, could undoubtedly be now attained, and very good bricks of an excellent quality might be made with the materials furnished by the soil of the isthmus, if able workmen should be introduced, either from Europe or the United States. It would be a precious resource for the construction of the works of art, as bridges and viaducts required in the establishment of a canal.

4. *Lime.*—Two different qualities of lime are used on the isthmus. At Panama, and on the borders of the Pacific ocean, where calcareous rocks cannot be found, the lime required for masonry is made, though in very small quantity, with the shells picked up on the sea shore. This resource would certainly be inadequate for an extensive work, requiring, within a very short time, the execution of many works in masonry; but the shores of the Atlantic ocean will amply supply this deficiency. The fossil polypus, found in large quantities in the bay of Limon, is used at Chagres as limestone: they are still more common at Porto Bello, where they are also used as freestone. I have seen in this city ancient columns, of pretty large dimensions, made of polypus. To these resources may be added the calcareous rocks of Vamos-Vamos, as well as another limestone which I have been told exists in the island of Taboga, in the Gulf of Panama, for the truth of which I cannot vouch, as I have not seen the latter either *insitu* or as a specimen.

The lime produced by fossil polypus, and that obtained from the shells of the Pacific ocean, is exceedingly rich, (gras,) and, consequently, cannot be advantageously used with mixture for the making of the mortar required for the hydraulic works of a canal; however, with this lime, good hydraulic cement has been made at Panama; I think its fitness to water constructions is owing to the admixture of a certain quantity of sandy clay. The walls of Panama, beaten almost constantly by the sea at high tide, perfectly resist its action; but I have been unable to obtain from the masons of Panama any positive information with regard to the composition of the mortar employed in their construction. The somewhat argillaceous limestone of Vamos-Vamos would certainly furnish hydraulic lime by the action of fire. I am also of opinion that certain argillaceous varieties of porphyry of trap formation, might produce, by calcination, good artificial pouzzolana. But fortunately, there is no necessity for applying these suppositions, which are only probable. The island of Guadaloupe contains enormous banks of excellent pouzzolana, the transportation of which to Chagres would not be more costly than the pouzzolana of Rome is at Marseilles or Algiers, and which, with the rich lime made with polypus, would form an excellent hydraulic mortar.

5. *The sand.*—There is no layer of sand on the isthmus; it is not even probable, from the nature of the soil, that any can be found. It does not ensue from this assertion that sand is wanting. The numerous brooks on the isthmus deposite on their banks a large quantity of it, and the strands on both oceans afford an inexhaustible supply. The use of sea sand, which might be attended with inconvenience in the construction of works above the surface of the soil in a country generally damp and abounding in rains, would be available for the artificial works of a canal, which must be constantly under water.

Timber.

I shall close my observations on the material which the isthmus could yield for the construction of important works, with a few words on timber.

The vast forests, covering almost the whole extent of the isthmus, interrupted in some places by sabanas or natural prairies, and sometimes by fields of corn, rice, bananas, and sugar canes, afford a great variety of timber. The knowledge of their natural riches is very limited. Researches in this line will lead, undoubtedly, to the discovery of valuable resources heretofore unknown; but to avoid speculating even on these suppositions, most likely to be realized, I shall only mention those trees which are most generally in use. It is universally known that barges of one single piece of wood are made by the Indians by hollowing out the trunks of trees. These trees, of which the boats employed on the river Chagres are made, are very common in the forests of the isthmus, and, beyond a doubt, the most remarkable I have ever met. This species of trees, the technical and French name of which I am unfortunately unable to give, is called *quipo* by the inhabitants of that country. It is formed of a vertical trunk, perfectly straight and cylindrical, (its conicity being less marked than that of the pine and fir trees,) slightly narrowed at the basis, and attains sometimes an elevation of 20 metres, with a diameter ranging to 3 metres in its thickest part, 1.50 metres from the ground. The trunk ends abruptly in its upper part as if it were cut off, darting from this extremity a few round horizontal branches, bearing a great resemblance to those of the oak. The lower part of the trunk is perfectly smooth, without knots or branches. Heretofore, this tree has merely been used in the construction of barks. I have seen some of this description of one single piece, 20 metres long by 2.50 metres in width. But it may be imagined that trunks of the above dimensions can only be had from trees growing on the banks of rivers. Quipos of a truly remarkable size fall into decay in the heart of the mountains for the total want of means of transportation; a circumstance truly deplorable, but not at all astonishing in a country without roads or population, when we find that the same happens in certain parts of France, and especially in Corsica.

The timber more generally used for building and by carpenters, is that of the meddlar tree, (*nispero*,) the mango, and the cedar

trees; but these names, given by the Spaniards to the trees of the countries discovered by them, merely indicate a certain analogy, not a perfect similarity, to the European trees of the same name.

The *nispero*, generally used for carpenters' work, furnishes a hard and heavy wood, which has, for the purposes of the isthmus, the advantage of not being attacked or injured by the *comejen*, a small white worm, which destroys almost every sort of wood, this being sometimes difficult to prevent. On account of its hardness, it can only be used in works requiring particular attention.

This wood, the most valuable of all those which are known or have been employed heretofore in the isthmus for the frame work of buildings, seems unfit to be used under water; this is at least the opinion of some carpenters whom I have consulted. However, it may retain under ground the qualities which make it durable, for I have seen large supplies on the borders of the great lake of Chiriqui (Atlantic ocean) for the cross sills of a railroad completed in Jamaica.

The *mango* is also frequently used for the frame work of buildings; but is less valued, and only adapted to structures requiring little durability. It yields some rather handsome pieces, affording several varieties of different quality, ranging in price from one-fourth to one-half of that of the meddlar tree. The prices are from 3½ to 6 dollars the dozen beams, 4.80 metres and 0.18 square, (1 fr. 50 c. to 2 fr. 30 c. each;) the beams of the meddlar tree of the same dimensions are worth one dollar (5 francs) each. The cedar tree, although of large size, is generally sawed into planks for buildings; this is, however, the tree out of which the small craft on the north coast of the isthmus are made; and for this usage is exclusively employed by the Indians of the bay of *San Blas* or *Mandinga*. From this circumstance, it is useless to state that this wood most successfully resists the action of the water. The planks of cedar tree, 4 metres long, 0.40 metres wide, and 0.30 thick, sell at $6 per dozen, (2 fr. 50 c. each.)

I should also mention the *mahogany*, or at least the tree so called, as appropriate for buildings; it has no affinity but the name to that which comes from Santo Domingo, and is used by cabinet makers. The *guayacum* is another available tree, so excessively hard that the natives view it with respect, and leave it untouched in the midst of their clearings in the woods. However, it is used whenever hard pieces are required, especially for sugar mills. I will finally mention the *caoutchouc*, very common on the isthmus, but which unfortunately has not as yet been turned to advantage.

Of all the trees above enumerated, only two, the *quipo* and the *cedar tree*, can, in my opinion, be used for frame work in the construction of a canal; such works, principally consisting of gates and locks, being constantly under water, require wood the quality of which should not be affected by this immersion. The thick logs required for them could be furnished by the quipo, the boards and side planks by the cedar tree. This plan, by means of which excellent locks (portes) would certainly be had, cannot, unhappily, be effected under the existing state of things, except in rare local-

lities. These large trees which could furnish strong pieces, and are situated in the vicinity of waters which might facilitate their transportation, are scarce, and, besides, are rapidly carried away for the construction of barques. It would be necessary to have recourse to those growing in the heart of the forests and in places until now almost unexplored; not a simple path, but large roads would be required for the transportation of beams for the locks of a canal intended for the passage of vessels of the largest size; almost every tree would need a road, involving thereby difficulties and expenses disproportionate with the results to be attained. In my opinion this local resource can only be made available when trees of adequate dimensions will be found in the vicinity of the line of the canal. Under different circumstances it would be preferable to import the large pieces from abroad, for instance, from the United States; it might even prove convenient to have them already wrought. The usage of local resources must be postponed until some future period, when the country shall be more thickly settled and the communication more thoroughly established; then they will be needed for repairs.

These remarks do not apply to the cedar tree, which, being sawed into planks, can at all times be transported on the back of mules, and, consequently, through roads easily constructed.

CHAPTER VI.

Delineation and principal preparatory measures for the projected canal. Dimensions of the canal.

The communication to be opened between the two oceans across the isthmus of Panama, viewed in regard to commerce at large, and especially in relation to the interests of Europe, should be such as I have already stated, that a vessel sailing from France or England should directly reach Peru, Chili, or even China. Although the distance from Europe to Canton through the isthmus of Panama is greater than by the Cape of Good Hope, it is probable that, in case the canal of Panama should be constructed, this route would always be preferred for the voyage to China, both on account of the regularity of the trade winds which blow from east to west, and of the more easy navigation of the Pacific ocean, thereby rendering the voyage through Panama shorter than by doubling the Cape of Good Hope. The latter of these routes would only be pursued on the return from China to Europe.

The canal of Panama should be so constructed as to admit vessels capable of effecting the longest voyages, as those of circumnavigation, and consequently merchant vessels of the largest size. As regards sailing vessels, those of 1,200 tons burthen may be assimilated in their measurement to second class frigates, carrying 52 guns. These frigates are only mentioned because they afford a point of comparison and a more fixed basis, with more ac-

finite dimensions, than the variable ones of merchant ships. Notwithstanding, I am not of opinion that, in the execution of a work exclusively destined for industry and commerce, which are the fruits of peace, and the progress of which is impeded by war, we should turn in the least our attention to vessels of war. It will be readily conceived that the increase of all the dimensions of a canal, and of the architectural works accompanying its execution, required for the passage of ships of the line, carrying 120 guns, would enormously increase the expenses without a sufficient compensation in the advantages to be derived from the annual passage of some war ships of that description.

France owns but few merchantmen of 1,200 tons; whaleships generally measure but from 500 to 600 tons; but England, whose navy is more considerable, has several of them, which make regular voyages, especially those belonging to the East India Company. However small the number of these large vessels may be, when compared with that of smaller size, I think that these exceptions, which may become more rare every day, in proportion to the extension of commerce with remote nations, should be called to participate in the benefits of a means of communication so universally useful, and established for the advantage of commercial intercourse.

The following are the principal dimensions of vessels of 1,200 tons, or rather of the second class frigates, with which the former may be assimilated:

	Metres.
Length of deck	53.50
Length from outside the taffrail to the end of the cut-water.	60.40
Extreme breadth of beam	13.78
Maximum draught when laden	6.50

The displacement in metric tons of 1,000 kilogrammes is of 2.352; of which one half, 1.176, represents the tonnage in burthen—nearly 1,200 tons.

These proportions, with the exception of the draught of water, are shorter by far than those of the large transatlantic steamers, constructed for several years past, to wit:

	French transatlantic.	English transatlantic.
Length of deck	72.10 metres	72.20 metres.
Breadth	12.05	11.10
Breadth outside the wheels	18.05	17.10
Draught	6.05	6.20

The latter are greater both in length and width than those of the largest men-of-war. A canal which might admit these enormous steamers would only require a small increase of depth to admit ships of war carrying 120 guns; its breadth, and, above all, the dimensions of its architectural works, would exceed by far those of a canal only constructed for sailing vessels of 1,200 tons; and this difference of dimensions would so far increase the cost of execution as

to induce us to examine whether they would be compensated by the passage of transatlantic steamers across the isthmus of Panama.

I have already stated that, by the opening of the isthmus of Panama, it is intended to abridge the voyage between Europe and the western coast of America and China, without subjecting merchandise to a transhipment, always involving a loss of time and capital; but this transhipment, so much dreaded by commerce with regard to merchandise, offers no material inconvenience to travellers and correspondence, so far as the advantages derived from celerity are concerned. It is difficult in their actual state even for first class steamers to carry a supply of fuel for a voyage of twenty or twenty-two days; in fact, they only take passengers, correspondence, and a few valuable goods. The transhipment of such a cargo could offer no serious inconvenience. A small steamboat, expressly destined for the service of the canal, and capable, by its dimensions, of entering the locks intended for vessels measuring 1,200 tons, might speedily transport travellers and correspondence from one end to the other of the canal. The inconsiderable loss of time occasioned by each transhipment would not sensibly affect a voyage of an average duration of 40 or 50 days. Nothing, therefore, seems to indicate, in the existing state of things, the advantages to accrue by the passage of large transatlantic steamers through a canal across the isthmus of Panama; and, though it may be adduced that, by means of future improvements in naval architecture and machinery, steamers will be advantageously adapted to all the purposes of commerce, the more probable contingency may, on the other hand, be anticipated—that of the screw taking the place of the wheel, whereby steamers will not exceed the dimensions of a 52 gun frigate.

It is for these reasons that I have based the dimensions of the canal on those of the above named vessels, and those transatlantic steamers only will be admitted in the canal which, on account of their size, can enter the locks.

Those canals on which extensive business is not carried on can be constructed in such a manner as to afford a passage for a single boat, by establishing here and there docks for the crossing of boats running in opposite directions. For such a canal as that of Panama, which would be immediately in use, bidding fair to increase its trade to a considerable extent in future, I would propose dimensions which would permit the crossing of two large vessels on its whole length, with the exception of the great ditch, which would, of course, be established in the dividing ridge, so as to lower it as much as possible. Pursuant to these considerations, and taking as a basis the dimensions of 52 gun frigates, already alluded to, I propose the following as the dimensions to be given to the canal.

1. A depth by only 0.50 metre greater than the greatest draught of the largest vessels to enter the canal, or 7 metres.

2. Width of the canal in the ground on a level with its water 45 metres, (somewhat more than three times the breadth of the largest vessel.)

Width at the bottom, 20 metres.

Width at a level with the tow path, 1 metre above the water, 48 metres.

As the banks have an inclination of 1½ in the base to 1 in height, they require at 1.50 metre in depth a footway to prevent the crumblings of the upper parts. The tow path on each border would be 6 metres wide, to be reduced to 4 in the ditches.

3. As in the rocks an inclination in the slopes of only one-tenth would be required, the width would be:

At the edge of the water	40.00 metres.
At the bottom	38.50 "
At the level of the tow-path	40.20 "
The latter included	48.20 "

4. Finally, in the large trench or ditch of the point of division, which would only afford a passage for one vessel, I would recommend a width at the edge of the water of | 17.00 " |

This, with an inclination of one-tenth in the slopes, would give for the bottom | 15.60 " |

On a level with the tow path | 17.20 " |

Including the latter | 21.20 " |

As this part would not admit of two vessels going in opposite directions, a single tow-path would be required.

I have been led to suggest these dimensions, partly because the economy consequent on the reduction of the width of the canal to that only required for the passage of one vessel, with the necessary construction of a dock for crossing at each level, would be insignificant when compared to the total cost; and partly because these expenses would be considerably increased if the same width should be assigned to the point of division as given to ordinary ditches in the rocks, and this would almost double the cost, which forms by itself a considerable portion of the total expense.

With regard to the dimensions of the locks required for the canal, they are indicated by those of the largest vessels requiring admission, to wit:

Width	14.20 metres.
Length between the noozles	64.00 "

These dimensions would admit of the entrance in one lock of two merchantmen, of 300 tons, being 35.50 metres in their greatest length, and 9.15 metres in width, or two 16-gun brigs, 34 metres long and 8.96 metres wide, or two small vessels of 380 tons, having at most 35.90 metres in length by 8.48 metres in breadth.

The above dimensions are greater by about one-fifth than those of the Caledonia canal, which is the largest canal of our day, and constructed for the passage of third class frigates. It is 6.10 metres deep, 37 metres wide at the level of its waters, and 15.20 metres wide at the bottom; its locks are 12.20 metres wide by 53.40 metres long.

The most important of all questions connected with the survey of a canal, is the dividing ridge, and it is necessary to select a position above the level of both extremes in order to determine the summit level; for it is on its height and position that the number of locks to be constructed on each slope depends, varying the cost of execution and the duration of the navigation of the canal, as well as the facilities for supplying it with water. My efforts have been principally directed to the finding of a summit level across the chain of mountains running along the whole extent of the isthmus. Having come to America after the announcement made by the Salomon company of the discovery of a minimum height of the central ridge of only 12 metres above the highest tides of the Pacific ocean, it may be easily conceived that I have sought this remarkable point with much eagerness. However, I had lost all hopes of realizing these marvellous assertions even before visiting the spot. Mr. Morel, the agent, not the engineer of the company at Panama, with whom I was immediately made acquainted, and to whose kindness I feel pleasure in acknowledging my indebtedness, assured me that he was unable to account for the error committed in assigning 12 metres as the height of the summit level. No exact levelling, no observation whatever, had been made on the isthmus, with the exception of isolated barometrical observations on a line not designated by the company for the canal they had in view. Besides, these isolated observations, of which I shall speak hereafter, and from which it was utterly impossible to come to the conclusion of calculating such an insignificant elevation as that of 12 metres, could give no satisfactory result in a region where the barometer regularly presents considerable daily changes, often of about 2 millimetres, and sometimes even of 3½ millimetres, (on the 23d of June, 1844,) equivalent to a variation of about 40 metres in height in the levellings of the soil.*

It follows, from what I have stated in the topographical description of the soil of the isthmus, that the summit level of a canal must be looked for at the sources of the gutters, at the bottom of which the affluents of the basin of the Caimito run. This basin is divided into two more by the ridges of *Loma-Alta*, situated at about one-fourth of its length, measured from northeast to southwest. This

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*During my stay at Panama, (from the 25th of December, 1843, to the 5th of July, 1844,) a series of barometrical and thermometrical observations have been made, from which we may conclude:

1. That the elevation of the barometrical column varies between 0.75775 metres and 0.76300 metres; that this elevation represents regular daily variations of 0.002 metres on an average; that the maximum elevation takes place at half-past ten in the morning, and the minimum at about three in the afternoon. (No observation has been made in the evening.)

2. That the temperature varies during the day from 22 to 34 degrees. However, this degree has rarely been observed, probably on account of the thermometer being placed to the north, and, consequently, exposed to the rays of the sun after the month of May. The greatest variation which has been observed within the same day, is from 22 degrees at 6 o'clock in the morning, to 30 degrees at two in the afternoon. During the greatest heat the thermometer generally lies between 28 and 32 degrees.

The thermometer has only been once during the day below 25 degrees. On the 20th of June, at eleven o'clock in the morning, during a heavy rain and a south wind, it marked 23 degrees. This temperature was considered cold by the natives.

ridge separates the basin proper at the Caimito on the west, from that of the Bernardino, its most considerable affluent, which runs on the east.

The Salomon company had selected the valley of the Bernardino for a canal, and among the smaller gutters terminating therein, that of the Rio Copé, corresponding on the northern slope of the main ridge with the river *Paja*, whose name I have given to the mountain dividing them. The *Cerro Tigre*, a conical and isolated mound 120 metres high, is admirably situated in the centre of the basin of the Bernardino for facilitating the examination of this part of the main ridge. The result of the first observations made in this place was such that I was for some time in doubt whether I would direct the levelling by the mountain of Paja, or by that of *Ahogayegua*, situated further to the west. I selected, however, the first, because a height of 12 metres had been assigned to it by the Salomon company. The first barometrical observation made in a place contiguous to the Paja mountain—the latter being too difficult of access, and 5 or 6 metres higher—gave as a result a height of 120.87 metres. Other observations taken in the sequel, gave 118.98 metres, 120.22 metres, 120.77 metres, 123.14 metres; therefore 120.80 metres, on an average, allowing us to calculate the height of the mountain itself from 126 to 127 metres. (The exact levellings taken afterwards, have shown us that Paja mountain was 128.72 metres above the level of the highest tides of the Pacific ocean, and 9.50 metres above the point on which I had made the barometrical observations, whereby the elevation of the mountain, calculated by means of the barometer, would reach 130.30 metres—1.60 metres above the real height.)

The height of several points of the main ridge, corresponding to the basin of the Caimito, properly called, has likewise been calculated by means of the barometer; these are the points in a direction from east to west:

1. The mountain situated between the source of the *Rio Congo*, running south, and that of the *Pescado*, running north, 6,000 metres west of the Paja, having an elevation of 115.20 metres.

2. Another passage at the source of the Rio Congo, 2,500 metres west of the former, 151.40 metres high.

3. A mountain between the *Caño de las Piedras*, running south, and the *Rio Rompido*, which empties at the north into the Caño Quebrado, 11,500 metres west of the Paja mountain. Height, 160 metres.

4. A mountain between the *Rio del Espabel*, running south, and the *Rio Sanguinga*, flowing into the Caño Quebrado 14,000 metres west of the Paja mountain and 126.50 metres high.

5. A mountain at the source of the *Yaya*, running south into the Caimito 16,000 metres west of the Paja mountain, 24,000 metres east of the Cerro de la Trinidad, 129 50 metres high.

The latter is a point situated on the line followed by Mr. Morel in his barometrical observations. The result of that which he made on the 26th of July, 1840, at half past five in the afternoon, in a clear day, was—height of the barometrical column 0.753

metres, temperature 27 degrees of the centigrade and 30 by the thermometer.

The observation made in his presence, and in the same place, the 23d of June, 1844, at nine in the morning, gave the following result: barometrical elevation, 0.7548 metres; temperature, 26°.2. At Panama, at about 10 metres above the sea, the barometer varies from 759 to 764 millimetres. (The height of 765 has been observed but once, the weather being slightly rainy.)

From the observation of Mr. Morel, we might assign to the mountain of la Yaya an elevation of from 75 to 125 metres, quite at variance with the 12 metres announced by the Salomon company. The observation made at Panama at the same moment as that of the 23d of June, 1844, was—barometer, 0 7649 metres, thermometer 26°; free thermometer, 26°.2. The difference of level of both places arising from these observations, calculated by the tables of Mr. Oltmanns, is 119.50 metres; by adding the height (10 metres) of the lower elevation above the level of the sea, the Yaya will be seen to be 129.50 metres high, which is approximately that of the Paja mountain.

It is evident from what has been stated that all the summit levels observed are higher than the Paja mountain; however, that part of the ridge situated west of Lomalta, seems, when examined from elevated and distant points, to be more depressed.

There is a fact which might lead to believe in the correctness of this observation—that of the pelican's preferring, as I was assured, this place for the passage from one sea to the other. But these facts appear to me accountable by the difficulty in calculating the comparative elevation of points far apart, especially when they are at unequal distance from the point of observation; and, on the other hand, by the position held by the Cerro Grande, in relation to that portion of the main ridge corresponding to the basin of the Bernardino, almost completely masked by the former on the side of the North sea, rendering its elevation difficult to ascertain from the South sea.

Although it is always in the vicinity of the lowest pass that the most favorable point is found for the establishment of a summit level for a canal, the elevation of this pass is not always binding with regard to the selection of a line; the considerable works which are always required for the lowering of the summit level, and which the peculiar configuration of the isthmus renders more or less practicable, may be diverted from the lowest height, owing to the nature of the soil. In the present instance, it may be seen by the draught of the valleys through which the line of levels has been made to pass, that, although the canal should cross the dales of the Bernardino on the one hand, and those of the Paja on the other, the height of Ahogayegua, 3,000 metres further to the west, should be preferred to that of the Paja, for the former is better adapted for the digging of a deep trench of inconsiderable length, by means of which the summit level might be very much lowered.

For these considerations, I have come to the conclusion of adopting the basin of the Bernardino for the delineation of the canal,

and to prefer to all the dales of this basin that which terminates at the height of Ahogayegua, corresponding on the northern slope with a small brook, tributary of the Paja. The position of this elevation has been exactly determined by trigonometrical observations, made at the Cerro Tigre, at Lomelta, and on the savanas of the Bernardino. Its height has not been ascertained with the same degree of correctness; but after the examination of the ridge observed from the Cerro Tigre, I have been induced to assign it the same elevation as that of the Paja, even before the adoption of the line to be pursued by the canal. We are induced to believe, from the relative position of these three points, that this view is correct; however, to avoid an error which might place my proposed delineation in too favorable a light, I have felt it convenient to assign to the mountain of Ahogayegua somewhat more altitude than to that of the Paja; therefore, we shall lay it down as being 140 metres high.

If we examine the transversal profile of the main ridge of the isthmus, following a line which would connect the Bernardino to the Rio Paja, passing by the mountain of Ahogayegua, and which is the delineation of the proposed canal, we can readily see the facilities afforded by the soil for the construction of a large and deep trench, or even a tunnel. At an elevation of fifty-six metres above the level of the highest tides of the Pacific ocean, and at a depth of eighty-four metres below the highest point, the distance from the Bernardino to the Rio Paja is of but 6,650 metres. If we would lower it still more, and descend to an elevation of forty-one metres above the level of the sea, and of ninety-nine below the highest point, the distance between the two streams would only be of 8,000 metres. This depth below the highest point I should judge too considerable for the construction of a trench, although not very long;* but a tunnel might be constructed which, preceded by trenches of from forty-five to fifty metres deep, would be reduced to a length of from five to six kilometers, which, so far as the art is concerned, presents no insurmountable obstacle to the science of the engineer.

Those who have heretofore devoted their attention to penetrating the isthmus of Panama appear to have laid aside the idea of a tunnel for a canal admitting vessels of the largest size. M. Michel Chevalier, author of an excellent work on several projects for the junction of the two oceans, partakes of this opinion. "The nature of a maritime canal," says he, "is opposed to the construction of a tunnel." I have been long of this opinion; but, as several able and distinguished engineers whom I have consulted appear to entertain an opposite one, I have thought it advisable to see the question in this new light.

Two great objections can be presented against the construction of a canal such as that projected across the isthmus of Panama.

* The great trench of Huehuetoca, executed in Mexico for the passage of the waters of the lake of Mexico, is 20,000 metres long; but the altitude of the summit seems to be of but sixty metres.

The first, based on the enormous transversal dimensions of this tunnel, only refers to the difficulty of execution; it is within the province of art, and engineers can alone determine. The second, is rather connected with the difficulties to be met with in the passage of the tunnel when once constructed; for, however considerable its elevation may be, large vessels will be prevented from entering it, unless they lower their top masts. Finally, seamen will, for the most part, be unwilling to enter a passage in which they will be deprived, for some time, of the light of the sun. The latter, therefore, can alone completely raise this objection, although we should remark that there are few canals of inland navigation, with a summit level (biet de partage) that do not have a tunnel; and some of them have more extensive ones than that required by the breadth of the ridge of the isthmus. The only difference would lie in the proportions of the canal and the size of the vessels. On the other hand, the manœuvre of lowering the masts is often executed at sea without difficulty or great loss of time—it would even be more easily and quickly made on a smooth water. Besides, as the tunnel would facilitate the lowering of the summit level to a greater extent than the trenches, the loss of time consequent on the lowering of the mast would be compensated by that gained in the passage of a smaller number of locks, as all these would be avoided, which would be required by the difference of level between the trench and the tunnel.

The following are the dimensions which I would suggest for a tunnel, the ditch being the same as in the trench destined for the passage of a single vessel: the width of the tow path, would be 21.20 metres, and 1 metre above the level of the water. The lower masts of a 52-gun frigate are 25 metres above the level of the water; but, as the top-masts, when lowered, are higher than the former, it would be convenient, and quite sufficient, that the tunnel should have an elevation of 30 metres above the level of the water, and 37 above the bottom. Finally, as the hull of the vessel is only a few metres above the water, and the upper part of the tunnel would only admit the masts, which do not require a great width, the transversal section of the tunnel might be considerably diminished, and, therefore, the extent of the cutting required for its opening, giving to this section an ogeval form. In spite of this arrangement, it would still be considerable, and would range as high as 696 square metres, owing to the great vertical and horizontal dimensions, which I have mentioned above; but, besides the expense of time and money, the difficulties to be encountered in its execution would not be proportionate with these great dimensions. This tunnel would be constructed through those hard and compact rocks of crystalline amphibolite, which would not certainly require to be supported by a vault, and for which a layer of bricks would prove quite sufficient, if not unnecessary.

The construction of a tunnel is not now-a-days a work to puzzle the science of the engineer. The enlargement of the section only augments the difficulties in a movable soil, requiring a vault; but

when the soil is solid and compact, as in the present instance, it may rather be said to facilitate its execution.

On the other hand, a tunnel, when compared to a trench, has the advantage of considerably lessening the expenses of execution, of lowering the summit level, thereby facilitating the supply of water, of diminishing the number of locks, permitting their distribution in a more convenient way on the two slopes of the ridge, of which the southern one is principally very short. All these advantages, which will be more fully developed in the sequel of this report, and against which no objection can be raised but the practical difficulties for the passage of the vessels; for the difficulties of execution can, in my opinion, be easily surmounted, have determined me to propose, at the same time, for the lowering of the summit level, a trench and a tunnel, so as to furnish all the necessary elements to those who will be called to solve this question, which, to my knowledge, is as much in the province of the seaman as in that of the engineer.

Summit level, with a tunnel.

A tunnel could be constructed so as to have its bottom forty-one metres above the ocean, and ninety-nine metres below the summit, (the mountain of Ahogayegua,) and the level of the water forty-eight metres above the ocean. (I designate in this manner the highest tides of the Pacific observed at Panama.) It would be preceded by trenches, save in those places in which, by reason of the inequality of the soil, the cost of the tunnel would equal that of the trench; this altitude is about forty-six metres.

The length of the tunnel is thereby reduced to.....	5.350	metres.
The trenches preceding it have on the southern slope.....	1.570	"
On the northern slope.....	810	"
Making the length of the summit level of.....	7.730	"

Declivity to be regained on each of the two slopes.

The declivity to be regained by the locks is of forty-eight metres on the side of the Pacific ocean, by establishing the lower sluice between the locks on a level with the highest tides. It may be regained by sixteen locks, with a declivity of three metres each, to which a guard lock must be added in the place in which it empties into the ocean—seventeen locks in all. The difference of level on the northern slope on the side of the Atlantic ocean is greater. The exact level which has been taken from one sea to the other assigns to the highest tides of the Pacific ocean, at Panama, a greater elevation than the highest of the Atlantic ocean, at Chagres, of 5.89 metres. As the highest tides of the Pacific ocean are 6.10 metres,* whilst those of the Atlantic, at Chagres,

* The tides of the Pacific ocean have been measured at Panama by means of a scale more than seven metres long, which I caused to be placed on sub-marine rocks, which are only seen during the highest tides, 200 metres from the ramparts of the city. In these tides the foot of the scale was dry, and 0.20 metre above the water. I had also caused another scale to be placed at Chagres, in the port.

are but 10 centimetres. This difference of level is reduced in the lowest tides to 12 centimetres.

By the above figures, the mean level of the Pacific ocean would be 2.97 metres above that of the Atlantic; but the mean level of the Pacific ocean is not constant. The lowest tides are only 2.75 metres high, and their maximum is 1.90 metre below that of the tides of high water; their mean level is therefore 3.275 metres lower than the maximum of the latter, 0.125 metres lower than the mean level, and only 2.845 metres above that of the Atlantic. The average height of all the tides would be 2.938 metres, and would represent the difference in the mean levels of the two oceans.

Mr. Lloyd, who practised an exact levelling across the isthmus in 1829, was induced, as a result of his researches, to assign a difference of 1.052 metre (3.56 English feet) between the mean levels of the two oceans. This figure is quite inferior to those I have mentioned above; the difference between them may, in part, be accounted for by the uncertainty of the mean level of the Pacific ocean. I should state, however, in support of the results which I present, that, although the level which I have caused to be taken has not been corroborated to its whole extent, no more than that of Mr. Lloyd, I have ordered a portion of it to be ascertained, so as to test the correctness of the instruments, as well as to know whether the person in charge of them had become familiar with their use; and the result of this verification, which has been satisfactory, adds another probability to the exactness of the rest of the survey. The declivity to be made up for on the northern slope is therefore of 54 metres, (a difference of 48 + 6.02 between the high tides of the Pacific and the low tides of the Atlantic,) requiring 18 locks, 3 metres in declivity each, as those of the southern slope.

Delineation and distribution of the locks on the southern slope.

The canal on this slope is, properly speaking, but a lateral canal to the Bernardino, which it follows on its left bank as far as its confluence with the Caimito—never being more than 700 metres from it; it crosses in this interval, by means of viaducts, its two principal affluents, the Rio Copé, which runs from the Paja mountain, and the Rio Aguacate. Below the mouth of the Bernardino, the canal follows for some distance the left bank of the Caimito, then winds to the east, and, coasting the ocean, empties at about four kilometers from the mouths of the Caimito in the bay of Vaca de Monte. The length of this branch is 13,450 metres.

The distribution of sixteen locks, through a distance of 13,450 metres, gives, on an average, to each level (bief) a length of 840 metres. A single canal, that of Rochdale, in England, offers a more striking instance of an abundance of locks; their average distance is of but 520 metres. The Worcester canal has one every 900 metres; that of the Mersey, at Irwell, one for every 960 metres. On every other canal in existence the average intermediate space of the locks is more than 1,000 metres. The small extent of the space between the locks is an inconvenience for navigation whenever the level of the water is altered by the

introduction or flowing of an *eclusée*—(quantity of water consumed by the passage of a vessel through a lock.) The volume of an eclusée for the canal of Panama would be 14.60 metres × 64 metres × 3 metres = 2726.40 cubic metres. The width of the lock being one-third that of the canal, the level of a space between the locks 770 metres long (twelve times that of the lock) would vary 1 12th of a metre, or 0.084 metre, by the introduction of an *eclusée*—a quantity really insignificant.

For this reason there would be here no inconvenience in multiplying the locks, if the declivity of the slopes on which the canal would be established should be uniform, and if the locks could be placed at equal distances. Unfortunately this is not the case; for the declivity of the soil, which increases considerably as we approach the culminating point, forces us in this place to multiply the locks and the levels.

A rapid declivity may be regained either by frequent locks, separated by levels of inconsiderable length, or by groups of locks, separated by levels between of considerable length.

The latter system has been adopted for the locks of *Fonserane*, on the *canal du Midi*, and on several points of the Caledonia canal, principally at the famous stairs of Neptune, where eight sieves, grouped in a distance of 457.20 metres, required a total fall of 19.29 metres. The grouped locks, somewhat more economically constructed, offer the inconvenience of requiring a larger supply of water, and the still more considerable of impeding the circulation of vessels going in opposite directions, when they meet in the vicinity of groups of locks whenever one of them has entered those locks. The locks separated by levels of little length, offer the first inconvenience in a smaller scale, and always permit the passage of vessels by the spaces.

It is for these reasons that I have thought advisable to give up the grouped locks, and to adopt the short spaces between.

The lock which terminates the summit level on the Pacific side is followed by 5 levels, each being 180 metres long, (including the lock;) the sixth level, 450 metres long, throws the canal over the Chagres river by means of a viaduct. The following levels, to wit, the 7th, 8th, 9th, and 10th, are 500 metres long; the 11th, 1,000 metres; the 12th and 13th, 3,000; the 14th and 15th, 1,000 metres, and the 17th, 1,100 metres. The total length of the southern slope is, then, as follows:

Levels.

No. 1 to 5, 180 metres each; in all	900	metres.
No. 6	450	"
No. 7 to 10, 500 metres each; in all	2,000	"
No. 11	1,000	"
No. 12 and 13, 3,000 metres each; both	6,000	"
No. 14 and 15, 1,000 metres each; both	2,000	"
No. 16	1,100	"
Total	13,450	"

In the space No. 12 the canal passes by means of a second viaduct over the Aguacate river; the necessity of crossing this stream at a convenient elevation, has forced me to establish a part of this space in an embankment.

Delineation and distribution of the locks on the northern slope.

On the northern slope, and from the summit, the canal follows the basin of the Rio Paja, which afterwards takes the name of *Rio Bonito*, as far as its confluence with the Caño Quebrado, which it crosses by means of a viaduct. In the lower part of the basin of the Rio Bonito, the line of the canal follows the right border of the stream, and then deviates a little, so as to diminish the height of the embankment required for the viaduct. After having crossed the Caño Quebrado, the canal penetrates, by means of a trench 18.35 metres deep at the culminating point, into the basin of the Rio Gigante, winds it, crosses the Rio Gigante by a viaduct, then penetrates through a trench 20.80 metres, of maximum depth, into the dale of *Palenquilla*, which it crosses in embankment 6.50 metres high, a short distance from the huts, and finally reaches, by means of a trench 22 metres of maximum depth, *Barro Colorado*, on the borders of the river Chagres, 21,200 metres from the lock north of the summit level. Thenceforward the canal runs parallel to the river Chagres without encountering great obstacles in the soil, and leaves the river opposite the small village of Dos Hermanas, 700 metres above the mouth of the Rio Trinidad.

At this place the effect of the tides of the Atlantic ocean are already sensible; the current slow, even imperceptible during the high tide, excepting the period when the river increases. In the lower parts of the river the depth, which is generally considerable, varies from 3 to 6 metres, and rises sometimes to 11 and 12—even to 18. It then gradually increases in breadth, and attains 60 and 70 metres at Gatun, and 110 metres at Chagres. It can, therefore, be made subservient to navigation by correcting some of its sudden windings.

The total length from the lock to the north of the summit level to that which leads to the river, opposite Dos Hermanas, is 33,500 metres, and a fall of 54 metres to be regained on this length, presents, with locks of 3 metres descent, a mean length of 1,966 metres per level, being still more considerable than on the southern slope; but on this as on the other side, the descent being much more rapid in the vicinity of the culminating point, renders it necessary to multiply the locks in the upper parts, though not so much as to offer any inconvenience. The length of the levels is the following:

	Metres.
No. 1	750
2	630
3	640
4	980
5	750
6	700

	Metres.
No. 7	750
8	775
9	15,150
10	700
11	890
12	910
13	1,880
14	5,250
15	1,000
16	930
17	1,010
Total	33,560

The level No. 9, the longest of all, is also that which presents the greatest difficulties and the greater number of works of art; it requires two viaducts on the Caño Quebrado and the Rio Gigante; a third viaduct of smaller dimensions on the brook of Palenquilla, the large trenches which traverse the spurs separating the basin of the Caño Quebrado from that of the Gigante, the latter from Palenquilla, and Palenquilla from Barro Colorado; finally, the embankment required for the passage of these three basins. Below this space, the obstacles presented by the soil only require a somewhat considerable embankment at Barro Colorado, and three small viaducts over the two brooks running opposite Agua Salud and that in front of Peña Blanca. In short, the whole length of the canal between the Pacific ocean and the river Chagres at Dos Hermanas is of 54,740 metres, as follows:

Summit level	7,730	metres.
South branch	13,450	"
North branch	33,560	"
Total	54,740	"

The river Chagres might be converted at a little expense into a magnificent and excellent canal on its whole length between Dos Hermanas and its mouth. But the necessity of having an easy and safe access in all seasons of the year into a maritime canal constructed across the isthmus of Panama for the junction of the two oceans, and the obstacles to be encountered at the mouth of the river Chagres; the difficulty, or rather the impossibility, of removing them; the uncertainty of the results to be obtained from the works executed on the sea shore to counteract the obstacles presented by the current and by the banks of sand; the uncertainty of the permanancy of these results; and finally the contiguity of the bay of Limon, which offers a considerable depth of water for the anchorage of vessels, have prompted, for many years past, as I have already stated, the selection of the latter bay for the extreme point of the route which is to join the two oceans. As this opinion seems to me well founded,

I have adhered to it. It is, then, at this bay, and on its western shore, almost at an equal distance from its extremities, that I would suggest the location of the mouth of the canal, terminating on the Atlantic ocean. It would then become necessary to establish a communication between the bay and the river Chagres. The bottom of the bay is only 3,500 metres in a straight line from some points on the river Chagres. In these places the soil does not present great inequalities; and in some, especially between the bottom of the bay and the river Gatun, which runs from east to west, and throws itself into the Chagres a little above the village of Gatun, the inequalities disappear, the soil becoming almost flat. The inequalities of the soil can easily be remarked from the summit of the Cerro de Gatun, where I have placed a trigonometrical signal 2,200 metres from the mouth of the river Gatun, on the left border of the Chagres, and only 6,000 metres from the bay. Unfortunately, I can rely on no exact observation for the running of a canal on this part of the isthmus,* and I can only present approximate results; however, in support of my observations on the small elevation of the soil between the bottom of the bay and the river Gatun, I shall adduce some facts well known at the village of Gatun, the inhabitants of which make frequent excursions to the bay of Limon, for the purpose of collecting the numerous cocoa nuts, which cover the beach at the bottom of the bay. There are two roads to make this trip; one shorter and more dry than the other, and very craggy, is frequented during the rainy season, (I have followed it myself, at a time when I deemed it possible to execute the survey before the commencement of the rains;) the other, a great deal lower, is flat and marshy in several places. I was even assured that, when the rains are plentiful, the bay of Limon can be reached by ascending a small stream in a very light canoe, which then is made to glide on a miry soil as far down as the bay.

Although I am aware that full reliance cannot be placed in popular assertions, the opinion of Mr. Lloyd is given in their support. He expresses himself in the following terms with regard to the bay of Limon, and the practicability of its junction with the Chagres. "The distance from one of the most convenient bays, (so far as the anchorage is concerned,) and the river Chagres, by the most practicable road, is rather below three miles (4,800 metres). I have surveyed the intervening space, which is remarkably level, and convenient in every point of view, for the construction of a canal, which, being only required for this short distance, might leave the necessary depth for the passage of ves-

*Having been engaged during the course of the dry season (from December to the middle of May) in the survey of the isthmus between the river Chagres, at Dos Hermanas, and the point of the Bernardino, attained by the tides of the Pacific ocean, for these measurements cannot be practised during the rest of the year, the execution of exact operations between the river Chagres and the bay of Limon, which I had postponed until the termination of the first measurements, would have prolonged one year my stay on the isthmus. The difficulties being restricted to a space of three kilometers in extent, represented to be flat by all those who have examined it, I have deemed that the difference between a precise calculation and the results obtained by me could not compensate the inconveniences attending one year's delay in the termination of my labors.

sels of an average draught of water; obviating, in this manner, the inconvenience arising from the scarcity of water at the entrance of the river Chagres."

The entrance of the proposed canal could be located on the right bank of the river Chagres, somewhat below the mouth of the Gatun. This entrance might be protected by a guard lock—guarding the canal against the rise of the waters.

The delineation would follow, for some time, the basin of the Gatun, ascending it as far as the point of depression of the ridge. I would exaggerate the elevation of the latter by assigning it a maximum altitude of 20 metres above the low tides of the Atlantic. The canal, as it deviates to the north, crosses the ridge, and reaches the bottom of the bay of Limon, around which it turns on its western side, even penetrating into the bay to a certain extent, as far as the middle of its length, where it empties into the sea, after a run of 12,400 metres.

This part of the canal, almost totally established by excavations, even on points situated in the bay, and which would require to be deepened, offers no difficulty of execution. The trench required for the passage of the culminating point would have a maximum height of 20 metres above the level of the water, and for 3,000 metres would not be above 10 metres.*

The distance from Dos Hermanas to the mouth of the river Gatun, is 11,800 metres—measured by following the actual course of the river Chagres. This distance might be reduced to 9,310 metres, after making those rectifications required for facilitating its navigation. The total length of navigation between the two oceans would then be 76,450 metres, as follows:

Artificial navigation between the Pacific and the river Chagres.....	54,740 metres,	67,140 metres.
Artificial navigation between the river Chagres and the bay of Limon.....	12,400 metres	
Natural navigation of Chagres river.....	9,310	"
Total.....	76,450	"

Termination of the canal on the Atlantic ocean.

The bay of Limon, sometimes called in Spanish, "Puerto de Nasa," situated 8 kilometres to the northeast of the mouth of the river Chagres, is of considerable extent. Its entrance is 4,000 metres wide; its length, north and south, 6,000 metres; and its average width, which is quite regular, is 3,000 metres. Its depth is considerable everywhere except at its southern extremity, exclusively occupied by a beach covered with cocoanut trees.

In the middle of the entrance there is 11 metres water. In the middle of the bay there is from 7 to 8. The bottom is of mud

* Although this part of the survey is not based on exact observations, I am confident that my calculations will not be deemed exaggerated.

and muddy sand, affording good anchorage. Everything tends to make it an excellent port, except its exposure to the winds from the north, northeast, and northwest, which usually prevail, and sometimes with violence, in this part of the sea of the Antilles. The form of the coast, which tends to the northeast, affords the best protection to the west shore of the bay; it has also the greatest depth of water. These circumstances have induced me to point out for the termination of the canal or railroad, that shore of the bay near the middle of its length and a little inside of a small ravine, called Caño de los Colorados. In order to make a good harbor at this point, a mole, placed at the extremity of a promontory which is within the ravine, will be required to be extended into the bay 1,000 metres, where there is a depth of 9 metres water, which is more than sufficient for the anchorage of the largest vessels. The tranquil and sheltered space, situated between this mole and the entrance of the canal, presents a surface of nearly 5,000,000 square metres, or 500 hectares (50,000 acres.) According to the soundings practised during my stay on the isthmus, in the month of February, 1844, by the officers on the French brig of war, Le Papillon, Captain Sochet, commander, conforming in all respects to those made in 1829, by Mr. Lloyd, the depth of water is generally above six metres; nearer to the coast it is still from 5 to 4 metres; close to the very point of the Caño de los Colorados, 3 metres. It will then be seen that a minimum and uniform depth of 7 metres, which is that of the canal, can be easily given to this space, establishing thereby a safe and extensive harbor.

Termination of the canal on the Pacific ocean.

The coast of the Pacific ocean, on account of the great rise and fall of the tides, does not present as favorable a point for the formation of a harbor as the bay of Limon. There is one favorable circumstance, however, which is its situation at the bottom of the Gulf of Panama, which makes part of that zone of the great ocean which has assigned to it the name of Pacific, and which by its position re-entering within the land, insures a much greater tranquility of its waters. This circumstance, joined to the vicinity of the isles of Tabaga and Taboguilla, situated only 12,000 metres from the small bay of Vaca de Monte, (the proposed terminus,) is land in which there is a good harbor with good anchorage for the largest vessels, would preclude the necessity, for a length of time, at least, of the execution of any work intended for the protection of the termination against the rare and short tempests of those regions.

As the canal empties into the western shore of the bay, which is open on the southeast, it would only be required to lower the bottom so as to allow the entrance of vessels at half tide, thereby permitting their passage in and out during one-half of the day. 8 metres water would be required on account of the undulations of even a tranquil sea, which, being influenced by the tides, would give 11 metres water during the highest tides, when the level of

the sea would attain that of the highest level of the canal. The island of Taboga would be the most convenient place for vessels awaiting the moment of entering the canal, and to it would resort those going down to the Pacific. The small stream which flows into the bottom of the bay might be changed into a reservoir, closed by flood-gates which, by filling at high tide and emptying at low tide, would create a current continually cleansing the bay, and forming accordingly an advance port for the canal.

The small bay of Vaca de Monte is nearly semi-circular, with an opening of 350 metres. By soundings made the 4th of July, 1844, (two days after the high tide of the full moon of the 30th of June,) 3.10 metres of water at low tide was found in the middle of the entrance; 3 metres in almost every place across the entrance; 9.7 metres in the middle of the bay, and from 3.50 to 4 metres at a hundred metres from the shore. The tide of the fourth of July being estimated at 4.80 metres in height, the foregoing height would become, at half tide, 5.90 metres, and 5.40 metres at the entrance; 4.10 metres in the bay, and 6.40 metres at a hundred yards outside. Supposing a declivity of 0.005 metres at the bottom of the sea, to reach the depth of 8 metres at half tide, we should run 620 metres off the coast; the excavation should, therefore, be prosecuted to this point, a distance in all of 800 metres, including the length of the bay over a space 280,000 square metres in extent (28 hectares;) in order to render the entrance of this advance port safer and more accessible to ships, to maintain free from all impediments the pass thus excavated; and, above all, to render more certain the clearing of this pass by means of the waters of the above mentioned reservoir, the former should be protected on both sides by a causeway extending into the sea 600 metres at least.

By means of the foregoing works a safe port, of an easy access and egress, would most certainly be had at this terminus of the canal; the only exception to its safety would be during the violent tempests, very rare in this part of the South sea. But even this port would be inadequate to the future commercial intercourse with distant countries, should it augment in a ratio hardly to be calculated at present. Commerce would then be in need of a port situated at the very entrance of the canal, and not at the distance of 18 kilometres; and a port, too, which at every hour of the day might be entered by almost every sort of vessels. I cannot pretend to suggest a scheme for a port of this description; more time would be required for the mere study of the subject than I have been able to spend on this part of the isthmus. But this end might be attained, in my opinion, by connecting the two lateral causeways to the pass by a transversal mole, in the centre of which a guard-lock would be placed, transforming thereby the whole pass and the bay into a vast floating dock. A breakwater 800 or 1,000 metres long, located in advance of the lock, at a place at least 8 metres deep at the lowest tides, would protect it against the force of the waves, forming at the same time an advance port, where vessels might at all seasons find a shelter.

I merely point out the foregoing works, the execution of which

will be deferred, at all events, to a very remote period, and of which the dimensions and location can only be determined after long and careful labors.

Summit level with a trench.

I have submitted, in the first place, a project for a canal, in the event of the possibility being admitted of piercing the main ridge by means of a tunnel, because through this mode of construction the summit level is liable to be lowered. However, for fear that my opinion might be contradicted, I have also studied the question in the hypothesis that, the tunnel being set aside as not adapted to the nature of a great maritime canal, the summit level should only be established by means of a considerable trench.

The elevation of the trenches constructed heretofore in great public works does not exceed, in general, 25 or 30 metres; however, under some peculiar circumstances, this elevation has been considerably extended. I have seen, myself, the excavation of a trench 2,000 metres long, 40 metres of maximum elevation, and 10 metres wide at its basis, for the construction of a canal from Arles to Bouc, not far from the spot where this canal connects with the port of Bouc. It is well known that the great trench of Huehuetoca, formerly excavated in Mexico for the egress of the lakes in the neighborhood of Mexico, and which is 20,585 metres long, has a maximum depth of 60 metres; its depth is even, as stated by Michel Chevalier, between 30 and 50 metres, in a space of 3,500 metres.

In fact, these limits cannot be well attained but in works of more than ordinary magnitude, and under imperative circumstances. But, it seems to me, that a work so vastly and universally important as a maritime canal at Panama may admit of even more extraordinary effort; and that, in order to execute it, those limits can be transgressed which hitherto have been assigned to works of an ordinary kind. If the attention of the reader is called, on the other hand, to the fact that the above mentioned trenches have been excavated in an unfavorable, crumbling and movable soil, whilst those at Panama would be dug in a rock of crystalline formation, hard and highly consistent, requiring no support, he will come with me to the conclusion that, to some extent, the depth assigned to them can easily be augmented.

The maximum depth which I propose below the culminating point is of 84 metres, whereby the bottom of the trench would be 56 metres above the highest tides, and the level of the water at the summit level 63 metres. It does not strike me that it would be impossible to excavate a deeper trench in such a soil as that constituting the main ridge of the isthmus; but as the inclination of the slopes tend considerably to augment the clearings, and, consequently, the expenses, in proportion as the excavation is enlarged, the increase in the cost, and the difficulty of removing the enormous quantity of rubbish, should, in my opinion, induce us not to attempt it.

The soil is, at all events, better constituted than at Mexico; the trench, 24 metres deep at the culminating point, would only be 6596 metres long. However, by assigning to it the dimensions which I have established above, to wit: 17 metres at the level of the water, 15.60 metres at the bottom of the canal, 21.20 metres at the surface of the tow path, and a declivity of one tenth in the lateral slopes, the total cube of the clearings necessitated in the excavation of a similar trench would exceed six millions of metres. At the elevation in which this trench would be made, the declivity of both the slopes of the chain is such that it would be impossible to overcome it otherwise than by grouping the locks.

On the northern slope, the summit level would be immediately followed by five sieves and six grouped locks, by means of which the canal would descend to the level of the space between No. 1 of the first project, the length of which would therefore be reduced to 500 metres. On the southern slope, the summit level would be followed by two spaces, of 500 metres each, then six grouped locks would follow, terminating in level No. 2 of the first project, restricting, at the same time, its length to 160 metres.

In order to obviate the inconvenience of so inconsiderable a length in this level, I propose a lateral dock, excavated in the bed of a stream on which this level is located, affording the double advantage of augmenting the ratio between the surface of the level and that of the locks, and of affording at the same time a station for the vessels which would be constrained to wait for the passage of those engaged in the locks.

Supply of water for the canal.

The supply of water required for a canal can be divided into two different sorts, having each a separate cause, to wit: that bearing on a given point, and that bearing simultaneously and indistinctly on every point.

The first class, including, first, the passage of boats through the whole extent of the canal, requiring a consumption of water at the summit level; second, the movement of boats which more or less frequently touch at some points on the canal, without going through its whole extent; 3d, the loss of water consequent on the passage of boats by those spaces of which the lower lock has a greater fall than the upper one; 4th, lastly, the apparent filtrations having a local and known cause, and which are remedied by the application of cement, or otherwise. The latter inconvenience cannot be attended to in a project, because it is owing to local circumstances only apparent at the moment of its execution. In the canal of Panama, which is to have uniform locks with the same fall of water, its whole extent being navigated by vessels entering it, the loss of water occasioned by the passage of vessels through the summit level should be classed among the former. To these losses must be added the very inconsiderable one occasioned by the drains of the lock gates, which, although occurring at every lock, are made sensible at the summit level, as every level receives by the upper lock what it loses by the lower one.

The losses comprised in the second class proceed, first, from

evaporation; second, from filtrations and the imbibing of the soil; 3d, from bad management. The latter are generally of little moment, and might be avoided by an active vigilance; therefore, I will not dwell upon them.

The loss of water produced by the passage of a boat through a lock is represented by a sheet of water of a surface equal to that of the lock, and a height equal to that of the fall. In the present instance, this volume of water (called in French an *éclusée*) would be 64 metres × 14.20 metres × 3 metres = 2,724,300 cubic metres. Whenever a vessel traverses a level ending in locks of the same elevation, the passage into the upper lock gives to the level the water which it has lost from the passage of the lower one; but with regard to a summit level higher than the two levels between which it stands, both these losses, instead of balancing each other, are united. In sum, the passage of a vessel across the canal originates a loss of two *éclusées* at the summit level; it will then amount in this place to 2,724,300 cubic metres × 2 = 5,448,600 cubic metres. If we admit an average daily circulation of ten vessels of 500 tons, (equivalent to 1,800,000 tons per year, more than double the amount of the actual tonnage,) the consumption of water brought daily by the passage of vessels would be of 54,486,000 cubic metres.

The loss of water through the lock gate is commonly calculated at 300 cubic metres; these losses are, on the other hand, without regard to the number of gates, for each level receives by the upper lock what it loses through the lower one; thence the losses occasioned by these causes are equivalent to 600 cubic metres per day. Taking into consideration the greater size of the gates, I will calculate them at 1,000,000 cubic metres.

The exact losses arising from evaporation and filtration are more difficult to calculate. However, the result of observations carefully practised on the central canal, constructed in an argillaceous soil, analogous to that of almost the whole line of the canal of Panama, will lead us to a calculation sufficiently approximate. In the central canal, the losses caused by filtrations are considered equivalent to a sheet of water 0.05 metres thick, with a surface equal to that of the canal; those arising from evaporation correspond to a sheet of water 0.003 metres high. The first numbers may be admitted such as they are; but the latter should be increased in the relation in which the evaporation between the tropics stands with regard to that in France. This relation is, according to M. de Humboldt, as 16 to 10; I shall go still further, admitting that evaporation will daily take from the canal a sheet of water 0.01 metre high.

	Square metres.
Upon these premises, and the surface of the summit level of the canal being of 7,730 metres by 17.....	131,410
That of the southern branch, 13,450 metres by 45.....	605,250
That of the northern branch, 33,560 metres by 45.....	1,510,200
Making a total of.....	2,246,840

* I overlook the reduction in the evaporation attending the construction of a tunnel covering a portion of the summit level.

	Cubic metres.
The losses caused by filtrations and absorptions will be 2,246,860 square metres by 0.05	112,343.000
Through evaporation	22,468.000
Total.....	134,811.000

The whole amount of the loss of water in the canal may then be calculated at 190,615.360 cubic metres every twenty-four hours, as follows:

	Cubic metres.
From the passage of vessels.....	54,486.000
From the loss at the gates	1,000.000
From the filtrations, evaporations, &c.....	134,811.000
In all.....	190,297.000

Adding thereto about 10,000 cubic metres for unexpected losses; 200,000 cubic metres corresponding to a regular volume of water of 2 32 cubic metres per second, which can easily be obtained from the river Chagres.

According to a gauging practised in this river during the lowest tides, on the 26th of March, 1844, a little below the Gorgona, at a place situated 10.70 metres above the Atlantic, and 4.00 metres above the highest waters of the Pacific, the volume of water which it rolls per second is 19.452 cubic metres.*

In the supply of canals, too great importance has generally been given to the losses of water caused by the passage of boats through the summit level, they being only a small portion of those experienced by a canal, resulting from circumstances already mentioned. It is for this reason that the reservoirs destined to replace these losses have been located near the summit level. However, this method of supplying the canal offers serious objections for those of considerable length, and they are principally founded on the length of time required for the passage of the water from the summit level to the extreme point of the canal; they are more so in those canals which have very short spaces between the locks. These inconveniences have been more particularly referred to in an excellent memoir of M. Comoy, (civil engineer,) contained in the *Annales des Ponts et Chaussées* de 1841. The opinion of this able engineer has been, moreover, confirmed by the experience afforded by the great canals of the United States, such as the Erie canal, 256 kilometres in length, supplied entirely with water from Lake Erie, as also by other canals contiguous to rivers, which

* This gauging has been made on a portion of the river 120 metres in length, straight, and of an almost regular form, and has given the following as the principal dimensions.

	Width.	*Maximum depth.*	*Section.*
Upper part.....	25.00 metres.	2.50 metres.	42.80 square metres.
Centre	31.00 "	2.25 "	48.60 "
Lower part	30.00 "	2.20 "	48.86 "

The mean velocity, calculated from five observations made with a seconds watch, by Rating, is 0.51 metres per second. If we apply to these data the formula of Prony, $v = 0.416\,v$, and $Q = u, s$, we will find for the mean velocity $u = 0.416$ metres, and for the volume of water: $Q = 46$ square metres, $76 \times 0.416 = 19.452$ cubic metres

could certainly supply them as abundantly as it might well be wished, "in cases in which (as Mr. Chevalier remarks in his book on the Public Works of the United States) this supply seemed most easy to obtain." However, this has not been the case; for when commerce has been active, the supply has failed in several points, because in those narrow and level canals, when they become obstructed from the passage of boats, the water cannot reach with sufficient celerity the extreme level of each division, in order to supply the locks and make up for the losses arising from filtrations and evaporations.

It is, then, more convenient to distribute the reservoirs over the whole extent; and this method offers, with regard to a canal, at the dividing ridge the advantage of facilitating the supply, as it obviates the difficulty of obtaining water as far up as the summit-level.

The southern branch of the canal (coast of the Pacific ocean) is only 13,450 metres long.

The short levels which it presents are all concentrated in the upper part, and in the vicinity of the summit level; the latter can then easily supply them with the water which they may require.

The northern branch (on the Atlantic side) affords, properly speaking, no short levels, as the least considerable is 630 metres; but its length is sufficiently considerable, being 33,560 metres—twice and a half that of the southern branch. There might be some inconvenience in drawing from the summit level all the water required for it. I shall then propose to place a reservoir in the level No. 9, 15,150 metres long, the waters of which have a level of 21 metres above the high tide of the Pacific, and 26.80 metres above the high waters of the Atlantic. The distance separating this space from the summit level, represented by the length of the levels comprised between Nos. 1 and 8, is 5,920 metres; the length of the lower part of the canal, including that of the level, is 27,640 metres; but, by bringing a supply of water into this level, converting it thereby into a sort of reservoir, the length of the portion to be supplied by a single reservoir located at one of the extremes of the canal, is reduced to that of the lower levels, or 12,490 metres less than that of the southern branch.

Having located these two reservoirs, we can easily determine the volume of their waters. Those of the summit level are to supply the loss of waters caused by the passage of vessels, by the loss at the locks, and by the filtrations and evaporations on the summit level, as well as on an extent of 13,450 metres+5,920 metres=19,370 metres. The reservoir at the level No. 9, is only to supply the loss of water by filtrations and evaporations on a distance of 27,640 metres. The reservoir No. 1 is then to supply the following quantity of water:

	Cubic m.
For the passage of vessels	54,486,000
For the loss of water at the locks.....	1,000,000
	55,486,000

	Square m.	
Surface of the summit level	131,410	
Surface of the southern branch	605,250	
Surface of the upper part of the northern branch, 5,920 metres × 45 metres =	266,400	
In all	1,003,060	
Height of the sheet of water lost by filtrations and evaporations=0.06 metres		60,183,600
Total		115,669,600

Equivalent to a regular and continual volume of 1,340 cubic metres per second. The quantity of water to be furnished by reservoir No. 2, at level No. 9, will be the following: Surface of the levels from No. 9 to No. 17, 27,640 metres × 45 metres = ... (sq. m.) 1,243,800

Height of the sheet of water lost by filtration and evaporations ..... (metres) 0.06 } 74,628,000

Equivalent to a continued volume of 0.863 cubic metres per second.

Total of both reservoirs	190,297,600

All the wants of the canal will then be completely supplied by bringing, by the lateral canal No. 1, a volume of one cubic metre of water per second, and by the lateral canal No. 2, a volume of 1.00 cubic metre.

The following will be the dimensions of these lateral canals:

Canal No. 1.	Height of water	1.20 metres
"	Width at the bottom	2.00 "
"	Width at the level of the water	4.40 "

The slopes on each side having an inclination of 45°, and the longitudinal inclination being of 0.000.1 (1 metre per 10,000.)

Canal No. 2.	Height of water	1.00 metres
"	Width at the bottom	1.90 "
"	Width at the level of the water	3.90 "

The inclination of the slopes and the longitudinal deviation being the same as those of the lateral canal No 1.*

The point on the river Chagres from which each of these lateral canals is to be supplied should be at an elevation above the level of the sea, represented by the level itself of the water in the space which they are to supply+1-10,000 of the length of the lateral canal.

It appears from the levellings made by Mr. Lloyd, in 1829, of

* If we apply the formula of Prony—$Q=u, w,$ and $u=0.07\times\sqrt{0.005\times3213}$ R. I., in which L is the volume of water, I the longitudinal inclination, W the transversal section, R the ratio of the section to the perimetre attained by the water, we shall find—

For lateral canal No. 1—W=3.84 sq. m., R=0.71, R I=0.000071, U=0.41 m., and Q=1.574 cub. m.

For lateral canal No. 2—W=3.60 sq. m., R=0.82 m., R I=0.000082 m., U=0.45, and Q=1.102 cub. m.

which I have already spoken, that the river Chagres is at Gorgona 10.64 metres above the highest tides of the Atlantic; at Cruces, 8,500 metres above the Gorgona, 5.49 metres above the highest tides of the Atlantic; at the crossing of the road from Porto Bello to Panama, 31,995 metres above Cruces, 49.86 metres above the highest tides of the Atlantic.

As the water at the summit level of the canal is 48 metres above the highest tides of the Pacific ocean, and 53 80 metres above those of the Atlantic, by a vertical elevation on the river Chagres of 4.00 metres above the road from Panama to Porto Bello, the same level can be attained. According to the foregoing levellings, the declivity between La Gorgona and Cruces would be 4.85 metres, or 0.00055 metres per metre; between Cruces and the road to Porto Bello, 34.37 metres, or 0.00107 metres per metre; as in all rivers the declivity of the bed always increases as we recede from the mouth, we may admit as certain that the declivity of its bed in the upper part will be 0.0015 metres per metre; it will then be sufficient, in order to attain the summit level, to ascend the river $\frac{4 \times 1000}{1.5}$ = 2,667 metres. The point which would be attained would be 8,500 + 31,995 + 2,667 = 43,162 metres above the Gorgona; the distance from the Gorgona to the summit level, by turning the mountains, is, besides, of 15,000 metres; the length of a horizontal lateral canal, starting from the dividing ridge and ending in the river Chagres, would then be 58,000 metres; but the supplying canal having a declivity of 0.0001, representing a total fall of 5.80 metres, the reservoir would be ascended $\frac{5.80 \times 1000}{1.5}$ = 3,867 metres. Finally, the supplying lateral canal would be 58,000 + 3,867 metres long, or about 62 kilometres, and its reservoir would be established 47 kilometres above the Gorgona, at an elevation of 5.80 metres + 53.80 metres = 59.60 metres above the Atlantic.

We cannot expect the river Chagres to roll at such an elevation such a considerable volume of water as that of 19,453 cubic metres, which it has at the Gorgona, the more so as it has not there received the waters of its principal affluent, the *Pequeño*, which flows from the mountains of Porto Bello; but as the supply to be drawn from the river is merely a volume of 1,500 cubic metres water, we can have no doubt that it can afford it. Moreover, it will be possible to dam some of the streams flowing into the Chagres, so that their waters may be taken into the lateral canal in the point of intersection, in order to augment its volume should it be deemed necessary.*

* In case that a trench should be excavated at the dividing ridge, in which the water would be 43 metres above the highest tides of the Pacific, and consequently 15 metres above the tunnel, the length of the lateral canal would be augmented $\frac{15 \times 1000}{1.5}$ = 10,000 metres, and the latter would then be 72 kilometres long; its reservoir would be established 58.80 metres above the Atlantic.

By means of a small dam at the junction of the lateral canal and the brook of *Baila Mona*, the last of those traversed by the former before reaching the canal, a reservoir will be established for the purpose of retaining the mud carried down by the Chagres in rainy weather.

With regard to the lateral canal No. 2, which is to supply the level No. 9, the point in which it will join the canal is 14,000 metres from the Gorgona; the level of this space is 21 metres above the Pacific, and 26.80 above the Atlantic; we find the same level on the river Chagres, 11,300 metres above Cruces, 19,800 metres above the Gorgona, and 33,800 metres above the junction of the lateral with the main canal. The total fall of water on this extent, based on a declivity of 0.0001, will be of 3.38 metres, corresponding on the river Chagres to a distance of 3,200 metres, which, added to the preceding length, will give to the lateral canal an extent of 37,000 metres. Its reservoir will be located 14,500 metres above the Cruces, and 30.20 metres above the level of the Atlantic ocean. An extra reservoir would be established for this as well as for lateral canal No. 1, on a small brook traversed by the former at a place contiguous to the main canal.

By means of these lateral canals, the supply of water for the canal would be amply secured; however, other resources might be superadded, as for instance, a vast reservoir established by means of a dam in the gutters terminating on the basin of the Rio Paja, above the locks at the extremity of the summit level. Therefore, by establishing on the *Rio Lirio*, about 1,000 metres above its confluence with the Paja, a dam 20 metres high and 1,000 long, a reservoir would be formed of 1,500,000 square metres in surface, and 15 millions of cubic metres in capacity; by diverting into this reservoir the waters of the upper part of the basin of the Rio Paja, all those might be collected which annually fall on a surface of 21 millions square metres. It is a known fact that the rains are by far more copious in southern climes, especially between the tropics, than in the north of France; in Paris the rain water represents a sheet of from 50 to 55 centimetres thick; it is calculated between the tropics at from 2.70 metres to 3 metres; allowing at Panama to the rainy-water an annual height of 2.50 metres, a surface of 21 millions square metres would receive 52,500,000 cubic metres of water, by far more than what the above mentioned reservoir could contain. Such a reservoir would suffice for the supply of the canal during 62 days, in case that one of the lateral canals should require to be repaired, or would experience, against all probabilities, such a loss of water as to prevent the volume from reaching their extreme end. However, I do not look upon this reservoir as indispensable; I merely suggest it as an accessory resource of possible realization if in the sequel it should be deemed expedient.

Estimate of cost of the canal.

I shall not enter into the details of those calculations on which I have based the estimate of cost of the canal which I propose, as

they will be enumerated in the sequel, I shall merely state the results thereof, as well as the principal data on which I have established it.

The price of labor is undoubtedly the most essential, and, at the same time, the most difficult to estimate with accuracy. On the isthmus, where no public works are undertaken, no term for comparison is to be found, if we except the salary of some masons and carpenters, who, on account of their small numbers and the scarcity of work, are paid very high wages.*

Therefore, we cannot expect to find in the country a single one of the mechanics, (artisans,) as masons, carpenters, blacksmiths, &c., which the execution of the canal would require. Neither could workmen be found at all accustomed to the usage of tools in the throwing up of embankments. However, as it would be a matter of no difficult or long apprenticeship, the population of that district, and the neighboring countries, could be made available for the supply of hands. The workmen which I have occasionally employed in my surveys across the isthmus, in opening foot paths, but specially in clearing the line of the survey, have been paid from 2½ to 3 shillings per day;† their food was also given them, estimated at ½ or ¾ of a shilling; 4 shillings (2 fr. 50c.) constitute, therefore, the maximum of their wages. In the estimate which I have made, I have taken this as a minimum for the wages of laborers, and I have calculated on 3 francs, (60 cents,) those of the terrace makers ‡

Relying on these data, I have made the following estimates:

ART. I.—EMBANKMENTS, (TERRASSEMENTS.)

1.—*Summit level—length 7,730 metres.*

TUNNEL.

	Metres.		Fr. c.	Fr. c.
Length.....	3,300	..... at 6,700.00	.....	25,645,000.00

Trenches on both ends, (aux abords.)

		Cub. met.			
Southern slope.	1,570	816,729,600	excavations in the rock... at 7.62..	6,223,479.55	
Northern slope.	810	513,780,625	excavations in the rock... at 7.51..	4,063,634.78	
Together.....	....	1,330,489,225	.....	.....	10,307,116.33
Total...	7,730 metres	.....	.....	.....	48,152,116.33

* A mason's or a carpenter's wages per day at Panama is 10 or 12 shillings, from 6 fr. 25c. to 7 fr. 50c.

† The main and almost the sole occupation of these workmen consisted in felling trees, a sort of labor at which they were perfectly skilful, the axe being the only tool which they handle at all.

‡ There are some places on the isthmus, especially the district of Chiriqui on the Pacific, west of Panama, to which workmen emigrate during several months in the year, to be employed in grubbing the ground; their wages range from six to eight dollars (30 to 40 fr.) per month, representing from 1 fr. to 1 fr. 25c. per day, to which their food must be added. This is the only data acquired with regard to the ordinary wages of the country; as for others, I have taken as a standard the corresponding ones in France, adding 50 per cent.; for this country, I have calculated at 7 fr. 50c. per day the wages of carpenters and stone cutters; at 5 fr. those of quarry men, blacksmiths, and so forth.

2.—*Southern slope—length* 13,450 *metres.*

1.—EXCAVATIONS.

Cub. met.		Fr. c.	Fr. c.
1,339,613,551	exc. in the soil...at 1.16.. (mean cost)....		2,214,749.96

EMBANKMENT.

		Fr. c.	
711,288,800	clearing.....at 0.25..	177,824.70	
1,289,721,600	earth removed....at 1.38..	2,047,535.68	
2,001,010,400.....			2,225,360.38
	Total.....		4,470,110.34

3.—*Northern slope—length* 33,650 *metres.*

1.—EXCAVATIONS.

930,000,000	exc. in the rock...at 7.56..	2,653,000.00	
5,738,586,696	exc. in the soil....at 1.22..	7,437,980.10	
6,668,586,696.....			10,090,980.10

2.—EMBANKMENTS.

4,302,632,113	clearings.....at 0.25 .	1,125,658.03	
878,991,575	earth removed.....at 1 58..	937,008.37	
5,181,623,628.....			2,062,666.40
	Total.....		12,153,646.40
Total between the Pacific ocean and the river Chagres, as far as Dos Hermanas.....			62,775,871.17

4.—*Canal from the bay of Limon to the river Chagres—length* 12,400 *metres.*

8,933,907,500	excavations in the soil.....at 1.94..	12,986,180.55
606,002,500	....do.....do..... .....at 1.19..	830,624.37
340,831,670	dredging.....at 3.63..	874,218.96
	Total.....	14,691,034.38

5.—*Regulation of the river Chagres—length* 9,310 *m.*

Excavation of the canal, 4,140 metres long, 10 metres mean depth on a section of 385.20 square metres:

Excavations 385.20 × 4,140 = 1,594,728 cubic metres, at fr. 1.15c.....	1,834,537.20

Deepening of the bed of the river on an extent of 5,170 metres—30 metres to be effected at the average price for the running metre, by dredging by steam:

465,300 cubic metres, at 2 fr.....	930,600.00
5,170 metres of tow-path, at 20 fr. per metre.....	103,400.00
Total.....	2,868,537.20

6.—*Lateral canals—on an extent of* 100,000 *metres.*

Estimated at 25 fr. per metre, including dams, bridges, &c..... 2,500,000.00

Total of [illegible]..... [illegible]

ART. II.—ARCHITECTURAL WORKS.

20 locks, at 920,000 fr. each	21,600,000.00	
2 large viaducts, 12 metres opening, at 265,000 fr.	795,000.00	
3 small....do.....3.....do.....75,000 fr.	225,000.00	
Total		22,620,000.00
		105,455,442.15

ART. III.—HARBORS ON THE EXTREMITIES OF THE CANAL.

1.—*Harbor of Limon, on the North sea.*

Mole 1,000 metres long; 6 metres mean depth of water; mean section 456.70 square metres.

TOTAL CUBE OF THE STONE WORK.

Sq. met.	*Cub. met.*	*Fr. c.*	*Fr.*	*c.*
456.85 × 1,000 =	425,850....at	8.00..	3,486,000.00	
Mortar.....	8,000....at	52.00..	416,000.00	
Running m. plank'g	1,000....at	20.00..	20,000.00	
Masonry.....	12,900....at	12.64..	163,050.00	
			4,085,050.00	
Dredging on a surface of 1,000,000 square metres, and a mean heighth of 2.50 metres =2,500,000 cubic metres, at 2 fr.....			5,000,000.00	
Total.....				9,085,050.00

2.—*Harbor of Vacu de Monte on the South sea.*

Two causeways 600 metres long—together, 1,200 metres; mean depth of water, 6 metres; mean section, 432.75 square metres.

TOTAL CUBE OF THE STONE WORK.

Sq. met.	*Cub. met.*	*Fr. c.*	*Fr.*	*c.*
414.70 × 1,200 =	497,640....at	8.00..	3,950,720.00	
Mortar.....	7,200....at	52.00..	374,400.00	
Running m. planking	1,200....at	15.00..	18,000.00	
Masonry.....	14,460....at	12.84..	182,774.40	
			4,525,894.40	
Dredging on a surface of 280,000 sq. met., and a mean heighth of 3 metres—840,000 cubic metres, at 2 fr.....			1,680,000.00	
Total.....				6,205,894.40
Amount to be appropriated for roads, houses for toll-gatherers, &c.....				15,250,214.40
				3,253,211.35
Total.....				125,009,000.90

I have not included in this estimate, amounting to a hundred and twenty-five millions of francs, the costing of the tunnel, which will probably not be required, on account of the hard and compact formation of the rock it penetrates. Should it be needed, its execution would add somewhat considerably to the expenses; the

running metres of brick coating would cost 2,600 francs, and therefore the whole coating of 5,250 metres of tunnel would come up to 13,910,000 francs, and the total expense to 139 millions. But I repeat it, this coating will not be required; and if it be so, only for a small fraction of the extent of the tunnel, and only on a portion of the compass of the vault; it is for these reasons that it has not been included in the estimate. At all events, in order to avoid contingencies, the sum of five millions of francs should be appropriated, making the expense altogether of 130,000,000 of francs.

It will be seen that this estimate has reference to the case in which the summit level should be established by means of a tunnel. Should a great trench be projected, of which the bottom would be 15 metres deeper than that of the tunnel, the amount of the expenses would be largely increased, not only by reason of the greater number of locks, but of the cube of the clearings.

We should add to the sum of 130,000,000, above mentioned:

For the summit level, 6,595 metres long—

		Fr. c.	Fr. c.
7,488,549,552 cubic metres of excavation from the rock	at	8.12	63,649,181.77
For the first 6 levels on each slope—			
881,763.35 m excavation in gravel	at	1.15	1,014,033.60
100,042.25 of loose clearings for embankments	at	0.25	25,010.56
For 10,000.00 metres of lateral canal	at	25 00	250,000.00
In all			64,938,228.93
For 10 locks, at 600,000 fr. each			6,000,000.00
Total			70,938,228.93

These several different works would come in the place of the summit level and the first level on each slope, the cost of which has been estimated as follows:

	Fr. c.	Fr. c.	
The summit level, by means of a tunnel	46,152,114.53		
Sum to be appropriated for the coating of the tunnel	5,000,000.00		
		51,152,114.33	
First level, southern slope		263,207.23	
First level, northern slope		552,720.00	
Total			51,968,041.56
Difference			18,970,187.37

This is about 19,000,000 more than the cost of the canal, should the project of a tunnel be adopted. In case that the summit level should be established by means of a trench of a maximum depth of 84 metres, the bottom of which would be 15 metres above that of the tunnel, the cost of the canal would ascend to 149,000,000.*

* A trench, of which the bottom would be on a level with that of the tunnel, would require an excavation of 9,316,930 cubic metres from the rock, which, at 8 fr. 12c. the metre, would cost ..... 75,651,845 francs.
The tunnel, with the addition of 5,000,000 ..... 40,845,000 "
The difference would then be ..... 84,806,845 "

In this case, the whole project might be estimated at 165,000,000. However, these numbers are only adduced for the sake of illustration; for the elevation of 99 metres assigned to this trench is, in my judgment, too considerable to admit of its execution.

From these numbers, it may be seen that the project involving the construction of a tunnel, affords, when compared to that requiring a trench, besides the advantages of a more expeditious and certain supply of water, and that of a shorter navigation, owing to the smaller number of locks and the absence of groups of locks, the still more palpable advantage of a great diminution of cost; for, even admitting the coating to be required for the whole extent of the tunnel, there would always be a difference of 10,000,000 in favor of the first project.

A greater economy in the expense might possibly be obtained by augmenting the elevation of the summit level; but it would only be had to the detriment of the project, and of those bases on which the canal should be established. I have seen a pamphlet in which it is suggested to construct a canal, the summit level of which would be established at an elevation of 105 metres above the level of the ocean, by means of a trench 25 metres deep; the height would be overcome by 35 locks on each slope. How could such a number of locks be placed on a slope of such inconsiderable length and steep declivity as the southern slope of the ridge, comprised between the Paja mountain and that of Ahogayegua? Even admitting the line to pass by the Paja mountain, so as to render it more extensive, (augmenting thereby the cost of the trench at the summit level,) we would be obliged to place 26 locks in a level not 5,000 metres long, giving to each level, including the lock, a length of 190 metres, supposing the declivity of the slope to be uniform, allowing the location of the locks at equal distances. Should it not be so, then the group of locks, the inconvenience of which I have already pointed out, would be necessarily augmented.

In either case the project would be so defective as to cause impediments in the navigation of the canal. Besides, this long chain of short levels and these grouped locks would consume a greater quantity of water, and its supply would be rendered more difficult by the great elevation of the summit level. In case that the water should be drawn from the river Chagres, the supplying lateral canal should be about 100,000 metres long; it being, moreover, to be feared that at the elevation of 105 metres above the ocean, the river might not afford, during the dry season, a sufficient quantity of water. The authors of the stated project have not had in view the river Chagres; they suppose that the streams contiguous to the dividing ridge, or, at all events, a branch of the Caimito, would suffice for the supply of the canal. This branch cannot be very long, for the distance in a straight line from the Paja mountain to the Cerro Trinidad, in which the Caimito takes its source, is of but 40,000 metres; but this very distance, by marking the small extent of the basin of the Caimito, shows, at the same time, that this river cannot supply the water required for the canal at those points contiguous to its source, in which the reservoir would necessarily be placed.

As to the other streams near the dividing ridge, they are all drained during the dry season. The Bernardino itself, and the

Aguasate only toll an inconsiderable amount of water, in places far below the level assigned to the dividing ridge. The difficulty, or rather the impossibility, of supplying a canal with water which has its dividing ridge at such a considerable elevation, affords ample reason for discarding a similar project. It could only have been suggested by persons very imperfectly acquainted with the localities, and above all, entirely ignorant of the enormous supply of water required for a canal.

The object I have had in view, and that of the mission entrusted to me, was merely to ascertain the possibility of constructing a canal across the isthmus, and to make an approximate estimate of the cost thereof. I do not pretend, therefore, to have formed a perfect poject, and still less to have pointed out the most convenient route. More thorough and minute investigations than those which I have been able to make in the short time spent on the isthmus, would lead to the discovery of a more available passage across the ridge, and requiring less expense than that pointed out by me; for I have only been guided, in selecting it, by the elevation of the mountains. The object I have had in view will have not been the less attained by demonstrating the possibility of joining the two oceans, and making a maximum estimate of cost, which can but be lowered by the discovery of a better route.

Besides the want of accurate levellings, both on the southern slope, between the bight of the Bernardino and the bay of Vaca de Monte, and on the northern one, between the river Chagres and the bay of Limon, such as would be needed for the digesting of a comprehensive project, and which I have not made for want of time, the necessity of keeping the line of the canal as near as possible to that of the levellings, so as not to incur the admission of too many hypothetical heights, has constrained me to retain in my project some defects with regard to the localities, which will be easily removed by a more minute survey. A better project than that which I submitted might be devised without deviating from the valleys which I have indicated, with greater reason, should a lower mountain be discovered in another portion of the ridge corresponding to the basin of the Caimito. The data which should determine the adoption of a peculiar valley, will be the exact elevation of the passage, taken by means of a level, and the greater or less facilities afforded by the soil for the excavation of a large trench, or a great tunnel; and these can only be demonstrated by forming a complete plan. However, as we are to be guided by economy in the selection of a route, I should remark that, if the two extreme points are adopted which I have pointed out for the harbors of the canal on the two oceans, by deviating west from the line which I propose, the route will be extended, and the cost will be consequently increased, even under the most favorable circumstances, 2,000 fr. per kilometre for the additional extent. Thus, for instance, selecting for a passage the mountain of la Yaya, a point advocated by the Salomon company, since it has been discovered that the elevation which they had announced to be 12 metres high, is in reality 130, the canal would be extended about

20,000 metres more than that which I have proposed; and besides, two great basins, that of the Bermudine, on the southern slope, and that of the Rio Pescado, on the northern one, would have to be crossed. The costs would then be increased at least 4,000,000 fr. for the 20,000 kilometres, 500,000 fr. for two viaducts, and 500,000 fr. for 20,000 metres more of lateral canals—in all, 5,000,000 fr. A saving of more than 5,000,000 fr. over the works which I propose at the mountain of Ahogayegua would be required in those of this new passage, in order to compensate for the increase of cost in cartage, consequent upon the greater increase in the total length of the canal.

Probable income of the canal.

The probable income of the canal will principally be derived from the toll paid by those vessels which will cross it; therefore, we should examine what class of vessels will take this route. This subject has been already discussed by more able pens than mine, and I can do nothing better than to subjoin what Mr. Michel Chevalier has said in reference to it, in the work which I have already quoted in the course of this memoir:

"Those voyages would be shortened, in the first place, by penetrating the isthmus of Panama, which are now made by doubling Cape Horn, the extremity of South America. Cape Horn is doubled on the way to Peru, to the western coast of Mexico, and to the adjacent possessions of the United States, of England, and even of Russia. It is by doubling this cape that vessels reach Australia, New Zealand, the Marquesas islands, the Society islands, (those countless archipelagoes of the South sea, which call for a master,) the Sandwich islands, coveted by more than one maritime power, because they hold between North America, China and Japan a similar position to Malta, between Spain, France and Italy, on one side, and the shores of the Nile and of Syria on the other. In order to foster the intercourse of Europe with these extensive regions, and that the myriads of our race may turn them to profit, the cutting of the isthmus of Panama would be extremely advantageous.

"With regard to China and Japan, as far as distance is concerned, no advantages are to be obtained. As the circumference of the earth is represented by 360 degrees of longitude, China, by the Panama route, is 230 degrees from us, or at two-thirds of the circumference. On the contrary, by the other route, if we overlook the very circuitous one around Cape Horn, the distance is of but 130 degrees—only one-third. The distance from Havre or London to Canton, around Cape Horn, is of 24,500 kilometres, crossing twice the line; through the isthmus of Panama, it would be of 27,000. But this excess in the distance would be more than compensated by the aid of the trade winds and the gulf stream, and the security of the voyage during the greater part of the year. A vessel, in fine, sailing from Europe to China by the isthmus route, would save fifteen days on a voyage from four to four and

a half months long; but that route should be abandoned on the return, for then they would have against them the gulf stream and the trade winds.

"A vessel sailing from Europe runs 27,500 kilometres by doubling Cape Horn, in order to reach the bay of Nootka, in the archipelago of Quadra and Vancouver, on the northwest coast of America, where an extensive fur trade is carried on, or the adjacent mouth of the Columbia river, which traverses the Oregon territory, belonging to the United States: by running through the isthmus, the distance would only be of 16,500. In order to reach Peru, the western coast of Central America, and the Mexican ports of Acapulco, San Blas, and Mazatlan, it would be equally of great advantage. As much may be said with regard to the Sandwich islands and the inhabited archipelagoes of the Pacific ocean. New Holland would stand in the same position as China. Finally, it is evident to all, that vessels which, on their way to China, should be willing to put into some of the ports on the western coast of America, from China to the bay of Nootka, should take the route across the isthmus of Panama.

"This problem assumes a different aspect with respect to the United States. That nation, eminently maritime, has already a vast commercial intercourse with China, and with all the countries bordering on the great Boreal or Austral ocean. It has engaged in fisheries with ardor and success; it possesses on the northwest coast of the continent the vast territory of Oregon, towards which the tide of population is impatient to rush through the interior, and which would rapidly be colonized, were it possible to reach it by sea, instead of climbing the rocky mountains, and traversing the deserts bordering on the right with the Mississippi, or those which the Missouri vainly seeks to fertilize.

"The cutting of the isthmus, under equal circumstances, would then be of an immense interest to the United States. But circumstances are not the same; the United States are nearer the isthmus than Europe is, and therefore, with regard to them, the advantages arising from the communication through it are manifest. The voyage from New York or New Orleans to Guayaquil, Lima, and Valparaiso would almost be in a straight line. There is from New York or Boston to Canton, by the actual route of the Cape of Good Hope, 25,000 kilometres; by the isthmus, the distance would only be of 23,000. With regard to this destination, the voyage through the isthmus is longer for Europe; it is shorter for the vessels of the United States. From Boston or New York to the mouth of the Columbia, in Oregon, the distance by Cape Horn is of 28,500 kilometres; by the isthmus it would be 14,000, or one-half.

"Thus, reproducing almost the very words of M. de Humboldt, the principal objects to be attained in the cutting of the isthmus of Panama are: the rapid communication from Europe and America to the western shores of the new continent; the voyage from Havana and the United States to China, the Philippine islands, and even to Japan, when our daring race of Japhet shall have forced this second empire on the extreme east to abandon its proud isola-

tion, as it has recently done with China; the colonization of Oregon and the isles of the great ocean; the navigation from Europe and the United States to China, touching on the western coast of America; and, finally, the great whale fishery. As regards the direct voyages from Europe to China, they, at most, would be facilitated on their way thither, but not on the return."

According to the tables furnished by the Department of Commerce, the number of vessels belonging to the four great maratime powers of France, England, Holland, and the United States, which have doubled Cape Horn and that of Good Hope during the year 1841, amounts to 2,966, measuring in all 1,203,762 tons, (405 tons per vessel, on an average.) It is impossible to distinguish those vessels which have passed by Cape Horn from those which have doubled the Cape of Good Hope; but, taking as a criterion the division of countries, we may approximately establish this distinction by assigning to the navigation around Cape Horn all those countries situated east of the Dutch East Indies, Sumatra, and the Sunda islands, and to that doubling the Cape of Good Hope, those lying between the Sunda islands and the eastern coast of Africa. This result has been obtained:

	Vessels.	Tons.
Navigation by Cape Horn.....	1,567	636,462
Do. by the Cape of Good Hope.....	1,399	567,300
Total.....	2,966	1,203,762

This is merely a conjectural estimate, and seems even to assign, in the actual state of things, too great a share to the navigation around Cape Horn. But this division might be deemed correct, should the isthmus be penetrated; for then those vessels bound east of the Sandwich islands, and even those going to Batavia, would adopt this route. Far, then, from deducting from the above numbers, we might be justified in augmenting them. The tables published by the Department of Commerce make no reference to the commerce of Spain, Russia, Sardinia, nor to that of Europe and the United States, with the western coast of North America, which can be estimated, at least, in 60,000 tons.

If we remark, on the other hand, the gradual increase of commerce during the years 1839, 1840, and 1841, and the progress which it might reasonably be expected to have made, up to the present time, we may, without indulging our fancy, admit the number of 700,000 tons as the most probable basis on which to establish a calculation of the revenues of the canal; these data, however, only refer to the passage of vessels in the actual state of commercial intercourse, not to that which would ensue from the increase of traffic originating in the opening of a new route which, while shortening the distance, adds to the facility and security of navigation.

Let us now examine the rate of toll to be paid by vessels crossing the isthmus. At first sight it seems natural to establish as a basis the tonnage of vessels, and to fix it in relation to the bulk

of the cargo; this is what has been proposed heretofore by those who have written on the subject; notwithstanding, the decree of the government of New Grenada, conceding the privilege of cutting a canal across the isthmus to the Salomon Company, bestowed upon the latter the right of establishing a toll with but one condition: that vessels of all nations should be admitted on a footing of equality. As to me, although of opinion that the tonnage of vessels should determine the rate of toll, it strikes me that we may view the latter as divided into two classes: the one, destined to pay the interest of the capital invested in the canal, should be defrayed by vessels in proportion to their bulk, and the advantages they will derive from this new way of communication, and therefore, with regard to tonnage; the other should be a fixed one for every description of vessels, for it is incurred in the passage of locks, which entail the same manœuvres and the same consumption of water, whatever the size of the vessels may be.

We feel justified in the supposition that the opening of the isthmus would, at least, abridge by one average month the voyage of vessels adopting this route; the economy derived, accordingly, by ship owners can be estimated as follows, with regard to ships measuring 300 tons:

	fr. c.
Expenses for the crew, equipments, food, &c.....	3,000 00
1½ per cent. interest on the value of the cargo, estimated at 100,000 francs.....	500 00
1 per cent. interest on the value of the vessel.....	900 00
Total of monthly expense.....	4,400 00
Difference of 1 per cent. on the aggregate value of the vessel and cargo.....	1,900 00
Total.....	6,300 00

Dividing the profits between the company and ship owners, the vessel should disburse 3,150 francs, or 10 francs per ton to the company. If we admit, to a certain extent, the principle on which I have based the division of the expenses, we will have a fixed toll for all vessels, and a variable one with regard to their tonnage. I propose to establish the toll in the following manner:

For vessels, 300 tons or more, 10 francs per ton; for smaller vessels, a fixed duty of 1,500 francs, and 5 francs per ton.

It may be objected to this tariff that it will be more burthensome to small vessels than to large ones; but, apart from the just principle on which I have based it, I will answer that small vessels will precisely abstain from long voyages across both oceans; they will prefer the coasting trade from the United States and the Antilles to Chili and Peru, to Mexico and the Oregon territory; having greater advantages to gain from the opening of the isthmus, they will be the more enabled to pay a higher price for the adoption of this new route.

To resume, a minimum income of 10 francs per ton may be ad-

mitted, or 7 millions of francs for the 700,000 tons passing through the canal.

We should deduct from this sum the cost of repairs and management of the canal, calculated at 6,000 francs per kilometre, according to the usual computation in France, where the repairs are calculated at 1,100 francs per kilometre, and the management at 1,500 francs; in all, 2,600 francs. The 76,500 metres of line of navigation will cause an annual expense of 459,000 francs, which I shall put down at 500,000 francs, so as to be above the probable expenses; the clear revenue will thus be reduced to 6,500,000 francs, precisely the revenue of 5 per cent. on the cost of execution, estimated at 130 millions for a canal of which the summit level should be established by means of a tunnel. To this, the principal source of revenue, another branch might be added in the sale or cultivation of the immense lands ceded by the government of Bogota to the Salomon Company, on granting it the privilege for constructing a route across the isthmus.

Although this concession has been annulled by a subsequent decree, founded on the non-execution of the conditions imposed by the government and accepted by the company, it is to be hoped, or it is rather certain, that the same advantages, or perhaps greater ones, would be granted to any respectable company which should propose to construct the canal of Panama under sufficient guaranty. However, I have only referred to those advantages upon which we can certainly rely in the calculation of the expenses; by omitting the cost of the lands which would be to a great extent ceded by the government, and of which that small portion belonging to private individuals, would be of little value when compared to that of the lands ceded to the company out of the line of the canal.

In the above proposition, with regard to the toll, I have desired to follow the course adopted on most of those canals in which it is divided into two classes; a canal duty, dependent on the tonnage of boats, and a toll for every boat passing a lock. I have devolved on vessels the costs of towage; besides, these costs would be by far below the tolls of the canal. In France, their mean estimate is 0fr. 05c. per ton and per kilometre, with a velocity of from 80 to 100 metres per minute. Adopting these numbers, which would not certainly be higher on the isthmus, where horses and mules sell low, and forage is abundant and cheap, the towage of one ton in the whole line of the canal would cost 3fr. 25c., and that of a vessel of 300 tons, 1,147fr. 50c., with a velocity of 80 metres per minute. The total line would be run in 16 hours. Adding the time lost in the passage of locks, 15 minutes in each, and for 36 locks nine hours, we see that the time required for going from one sea to the other would be 25 hours, or two days, supposing the passage of the canal only to be made during the day.

The transport of passengers and correspondence could be effected, as I have already suggested, by a steamboat, which, running 10 or 12 kilometres an hour, would make the trip in 14 or 15 hours. As to common vessels ladened with merchandise, would it be convenient to adopt a more rapid towage than that effected

by means of horses? I believe not. What interest would vessels have in gaining at most one day on a voyage of several months; and would they consent to pay the surplus of expense required for a more perfect towage? I have heard some persons suggest the adoption of steam tow-boats; but, unless the tow-boat should be enabled to enter the lock with the towed vessel, which would seldom be the case, only the expense would be augmented thereby, for then not 9 but 18 hours would be spent in the passage of the locks; and by averaging 10 vessels per day, 10 tow-boats, at least, instead of one, would be required.

Should a rapid towage be absolutely required, nothing could be more convenient than a railroad on the tow-path of the canal. In the project which I have submitted, the smallest curves have a radius of 400 metres, sufficient for a railroad on mean velocity (20,000 metres per hour;) some slight embankments would merely be required on the sides of the locks, so as to regain their fall by a uniform declivity of 1 to 1½ per cent., in order to adopt the tow-path, or a railway. This road would cost about 30fr. per metre, and its whole extent of 76,500 metres, the double on the outside of the summit level, 4,380,000 francs.

This is certainly a small expense when compared to the total cost of the canal; but I consider it entirely useless, and above all disproportionate to the advantages to be derived therefrom. It is true that this railroad would be available for the transportation of mails and passengers; but how many passengers cross the isthmus? The sailing packet which plies regularly once a month between Chagres and Jamaica, making, accordingly, 12 trips in the year, takes sometimes two or three passengers—at most 10. Adopting this maximum as an average for the voyage to and from, we will have the sum of 240 passengers per year. Some other small vessels from Havana and the United States frequent the port of Chagres, and occasionally convey passengers. Let us suppose these as numerous as those taken by the English packet; there would be in all 500 passengers crossing the isthmus every year. If we make allowance for the small intercourse subsisting between Chagres and Panama, this number may be increased to a thousand. Now, let us suppose that this number, undoubtedly above the maximum, should be ten times greater after the opening of the canal; there would be 10,000 passengers to pay the interest of a capital of five millions at least, if we attend to the value of engines, &c. Therefore, a revenue of 250,000, and, consequently, a gross revenue of 450,000 francs at least should be drawn from the canal, corresponding to a fare of 45fr. per passenger, or 6fr. 60c. per kilometre. This is about ten times the fare of railroads in France. In the presence of these facts, we should not hesitate in abandoning the idea of a lateral railroad.

CHAPTER X.

Means of execution.

Is the canal of Panama a work of such a nature that its execution may be exclusively abandoned to private enterprise? Are the pecuniary advantages to be derived therefrom such as to induce capitalists to undertake it with confidence?

The above estimate shows an expense of 130,000,000, and the probable revenue of 6,500,000—exactly representing the interest of five per cent. on the capital invested. The interest exceeds that drawn by stockholders of great public works executed under the supervision of private companies; therefore it might appear at first sight that private capitalists would easily furnish the funds required for a canal of this description. Indeed, I have no doubt that whenever the canal of Panama will be opened, and this new route fully known and frequented, the capital engaged in this enterprise will bring more than an average interest to the owners. But this result can only be obtained after a certain time; for, besides that which would be absorbed in the execution of so great a work, old habits, however obnoxious, cannot be expected to change in one day.

On the other hand, will an interest, deemed sufficient, so far as those national works are concerned which are executed almost in the presence of the stockholders, be regarded in the same light when the capital is invested in a remote work, in a country but little known, and of which the still infant government may not have that stability which companies are apt to look to for the rigorous fulfilment of a contract and the quiet possession of a grant?

As to me, it is a matter of doubt whether any company would venture by itself in the execution of the canal at Panama. I have heard, it is true, that some companies are forming for this purpose; but they are yet ignorant of the cost of the work, and accordingly of the interest to be drawn from the invested capital. For these reasons, their proposals cannot be regarded as very serious until the result of my mission shall be known and publicly discussed. Besides, these companies rely more or less on the support and intervention of the government.

France, which has taken the lead in the measures destined to throw light into a subject so long discussed, should also have the glory of executing this important work; but one of so great moment to all other nations cannot be left under the management of any one of them; its existence or its possession cannot be dependent on the issues of war. It should be established on such foundations as not only to have nothing to fear from the collision of rival maritime powers, but should even be a bond of union between those more or less interested in its execution, and a badge of peace instead of a cause for war. No nation, and still less no private company, should, either from caprice or interest, be left to decide whether another might be admitted to enjoy its benefits to the ex-

clusion of the rest. Therefore, two sorts of guaranty should be stipulated in the articles for the execution of the canal at Panama: 1st. In behalf of the undertakers of the work, a powerful guaranty that the concessions of the Grenadian government will be adhered to, and that it will protect them against the encroachments of any power more or less interested in possessing itself of the canal, to the prejudice of all other commercial nations. 2d. In behalf of the government of New Grenada, a clause stipulating that the grantees shall loyally and rigorously execute the conditions and charges imposed upon them, so as to be guarded against the failure of contracts on the part of private companies.

The conditions can only be fulfilled by the direct intervention of several powerful governments; the present period is a favorable one. The Grenadian government has heretofore contracted, though unsuccessfully, with private companies. The last one in possession of a privilege has retained it five years, not only without commencing the work, but even without obtaining any positive result, or without having adopted any project for communication whatever; therefore it has been declared void by the central government of Bogota. The latter, which had always determined that the privilege should never be granted to any government, has now become aware that, owing to the peculiar position of the isthmus, coveted by all commercial nations, this condition was an impediment to the execution of a canal; it has, accordingly, adopted an altogether different course, and seems to desire, on the contrary, the intervention of the great European powers. Consequently, we may anticipate, from the decrees issued in behalf of private companies presenting no reliable guaranties, the concessions to be obtained by those who would in fact achieve it.

The three great maritime nations most interested in the opening of the isthmus of Panama are France, England, and the United States.*

A treaty between them would guaranty the free and tranquil possession of this passage against the encroachments of any nation, not excepting the contracting ones. The subsequent accession of other nations interested therein, as Holland, Spain, Russia, &c., would but increase its force, binding them to mutual friendship. France and England, uniting to secure the execution of this work, might assign to the capitals engaged in the enterprise a minimum interest, until the moment in which the traffic through the canal would be a sufficient guaranty. An interest of 30 per cent. on the invested capital seems to me quite sufficient guaranty, the more so when guarantied by two governments like those of France and England. The latter thus directly interfering in its execution, and aiding it with their own means, would thereby acquire the right of acting as arbiters between the Grenadian government and the company entrusted with the enterprise, supporting, with re-

* Holland, though having an extensive commerce, is much less interested in it; her possessions in the Indies border the countries to be reached by the Cape of Good Hope, and those to be reached by the canal of Panama.

gard to the former, the just claims presented by the company, and pressing upon the latter the rigorous execution of all the stipulated conditions, and the fulfilment of all promises; they would determine the dimension and form of the works, and watch over their execution.

By means of this combination, the parties would obtain every desirable guaranty, and a plan might be fixed upon for the execution of the canal, according to the requirements of science, not to those of caprice, or the ignorance of a private company. It is the province of France and England, who have so often discussed and carried through principles rather of general and universal utility than of private interest, to follow in the present instance the same enlightened policy, and to combine in the execution of a work profitable to all nations, as well as to themselves.

One of the first works to be undertaken on the isthmus, after the delineation of the canal, will be a road which, by bordering this line, would be available for the easy transportation to every point of workmen, materials, provisions, &c. It could be constructed at a cost of from 1,000,000 to 1,200,000 francs. But this road would be essentially different from a route to be used as a commodious and regular channel for the passage of merchandise and travellers across the isthmus, and which should probably be established on a different line, deviating on several points from the canal.

In the pamphlet already mentioned, the authors of which suggest a canal having its summit level at an altitude of 105 metres, the idea is broached of a railroad between the bay of Limon and Panama. This railroad is represented as indispensable for the accurate surveys which should of course precede the definite project of a canal; but we can hardly admit the necessity of an improved means of communication, located, from its very nature, at a considerable distance from the line which it is expected to benefit, and the construction of which would absorb a considerable part of the funds destined for the canal; with regard to a definite survey, I must confess that I do not see the necessity or utility of such a road. Viewed as a permanent means of communication between the two oceans, it is but a work of merely local interest, not in the least advantageous for the governments of Europe, who should no more interfere in its execution than England has in the railroads constructed in France by English subjects. Still more, a railroad between the two oceans, far from leading to the execution of a canal, as it is seemingly indicated by the authors of the pamphlet, will be, on the reverse, an obstacle which will retard its execution for years to come. The authors of a project requiring an outlay of 15 or 20 millions for a provisional work cannot entertain the idea of a great canal parallel to it, destined to absorb its resources and annul its effects. It becomes evident to every sound man that the suggestion of a railroad conceals the purpose of indefinitely postponing that of the canal. It would then be impossible for any other company to construct the canal after the establishment of a railroad; for, besides the indemnity to be paid to the owners of

the railroad, the expenses attending the construction of the canal would so far increase as to prevent it altogether.

Should the European governments feel interested in cutting the isthmus of Panama, of which no doubt can be entertained, and intend to interfere in the subject, it is their duty not only to discountenance the project of a railroad, but even to prevent by every possible means a privilege for that purpose being granted by the Grenadian government to any such company, for such concession would evidently entail, at least for a long time, the abandonment of a canal.

In the course of my surveys and explorations, I have only had in view the general interest of Europe, and anything but a maritime canal is, as I have already stated, of no advantage to her. Had not this question been discussed by others, and had it not struck me that the construction of such a route would throw obstacles in the way of a canal, I would not have referred to a railroad, which, although possibly convenient for the isthmus, can be advantageously supplanted by a Macadamized route.

The construction of a great canal of communication between the two oceans, through the isthmus of Panama, such as I have proposed, would require the simultaneous employment of a great number of hands, the more so as the prevalence of the rains for six months in the year, from June to November, impedes any labor unsheltered during that season. Supposing this work to be done in 10 years, it would require—

5,000 laborers with shovel or pickaxe;
1,200 miners;
200 masons;
100 quarrymen;
100 brickmakers;
100 mortar carriers;
50 carpenters;

In all, 6,750 workmen, to which should be added three dredging machines with their crew, one on the Pacific and two on the Atlantic ocean.

The assemblage of so large a number of workmen in a country so thinly populated, the inhabitants of which are entirely ignorant of public works, would certainly be one of the greatest difficulties attending the enterprise. It would be accompanied by the heat of the climate and the unhealthiness attributed to it, although to some extent unreasonably. That cruel disease, the yellow fever, so much dreaded by Europeans going to the Gulf of Mexico, does not exist on the isthmus of Panama. Chagres, always depicted as a plague spot, equally horrid to see and dangerous to inhabit, is in fact the only unhealthy spot on the isthmus; and even its insalubrity has been grossly exaggerated. It is only unhealthy during the rainy season, especially from July to October, owing to the stagnant waters, which have never been drained, and which breed the intermittent fever. Besides, the line which I propose deviates from Chagres, and nothing appears on the bay of Limon, where the entrance of the canal would be located, to justify such

apprehensions. I can testify to the salubrity of the interior of the isthmus, although, to be true, I have only explored it during the rainy season.

There are some extensive swamps on the borders of the Rio Trinidad, though far from the line of the canal. No fear should, therefore, be entertained of the latter being affected to any great extent, nor that whenever terminated its navigation will be attended with danger to either life or health. In short, the climate is not such as to be dreaded by emigrant laborers; some simple hygienic precautions would preserve them from the effects of a high temperature. It would be imprudent, however, to expose European laborers to the action of the burning sun of the isthmus and the alternate influence of heat and dampness, the two principal promoters of fevers. It should, therefore, be established that none but the natives, or those of the neighboring republics and the southern States of America, should be employed in throwing up the embankments; they would only require a certain number of leaders or guides taken from among the European workmen. By this contrivance, the laborers might be sent back to their homes during the rainy season, as it is then impossible to work in the open air.

That part of the isthmus which belongs to Grenada is thinly inhabited; but a sufficient number of laborers, such as diggers and other low rank of workmen, could be obtained from that and the neighboring countries, who would have the advantage of being acclimated, and who, under careful task masters or "bosses," would very soon become sufficiently expert in the use of the spade, shovel, pickaxe, &c., &c. All the masons, carpenters, bricklayers, and other master workmen, would have to come from the United States, and could carry on their work during the rainy months, from June to November, under tents, sheds, &c., suitably located. To induce this kind of necessary emigration, it might be advisable to give each of the better class of mechanics a certain quantity of land taken from that which the Grenadian government would readily grant to any responsible company executing the work; and thus the nucleus of a thriving permanent population would be formed.

The immense herds of cattle scattered through the isthmus, and now killed only for their hides, with the extraordinary fertility of the soil on the large savannas, meadows, &c., where, in eight months, magnificent fields of corn, rice, bananas, and sugar cane could be grown, puts the cheap feeding of the large body of men required for such an undertaking beyond a doubt; in addition to which, the contract with a former company (now declared null and void) gave free entry to all supplies, and the same privilege would doubtless be again granted to a company formed with the ability and determination to carry to completion this magnificent plan of intercommunication between the two oceans.

A learned economist and distinguished engineer, Mr. Chevalier, suggests that, in order to carry this work into execution, disciplined soldiers, such as those of our corps of engineers, be taken to the

isthmus under command of their own officers. Without partaking entirely of his opinion, I think that the nucleus of a large emigration of workmen might be formed with men selected from the regiments of the corps of engineers, as well as from the rest of the army, so as to have the centre of a population half civil and half military, active, laborious, accustomed to discipline, obedience and labor, who would be examples to others, would furnish the heads of workshops and gangs of laborers, and whose presence would at the same time prevent a collision, almost inevitable between workmen from so many different nations. This sort of incorporation of soldiers with a civil population might be granted by the French government to the company under its protection, and obtained by it from the Grenadian government in return for its guaranteeing for the construction of the canal.

The route which I propose has been pointed at since the early period of the discovery of the isthmus. In 1528, but fifteen years after the existence of the South sea was discovered, it was proposed to construct a canal in the valleys of the Rio Chagres and the Cimito. For three centuries nothing had been done but superficial explorations, on which no serious discussion could well be founded.

Even those who were more deeply concerned—the grantees of the privilege for the junction of the two oceans—had lost in fruitless errands the time of duration assigned to their grant, and at the end of five years had not even determined the elevation of the dividing ridge and the extent of the projected route.*

It became the French government, which has taken the lead in so many scientific expeditions, to head a movement which is to terminate in the execution of a work of universal interest, to place the question in its true light, and subject it to public discussion all over the world. Though far from esteeming this project complete or faultless, I believe I have sufficiently accomplished the mission with which I have been fortunately entrusted. It seems to me that the possibility of connecting the two oceans across the isthmus of Panama is clearly demonstrated, and I hope that those who may be willing to peruse my work will partake of this opinion. The moment has come of effecting this important work, and France, which has opened the way in the serious survey of the isthmus, is bound, by her position, her interests, and the mission of civilization which she has filled with regard to all nations, to take the start in the measures to be proposed for carrying it into execution.

* According to the Salomon company, the length of the canal between Panama and Chagres would be 75,400 metres; and deducting the navigation of the river Chagres, of 54¼ kilometres—28¼ on the southern slope, and 26 on the Atlantic. It is apparent, from the exact and accurate plan which I have drawn, that the extent of the line of the canal between the two oceans would be 76,450 metres, and only 54,740 between the river Chagres and the Pacific ocean—of which 16,100 are on the southern slope, and 38,640 on the northern one. In order to reach Panama, (at Playa Prieta,) we must add 20 kilometres, which divide this point from the bay of Vaca de Monte; and thus the distance from Panama to the river Chagres is 74,740 metres—not 54,500, as announced by the Salomon company.

Comparison between the proposed canal across the isthmus of Panama and the projects submitted with regard to the isthmuses of Tehuantepec and of Nicaragua.

It might be imprudent in so important and expensive a work as a great maritime canal across the isthmus connecting North and South America, to begin it on any one point, before having ascertained that such a point is the most advantageous in every light. It may not be uninteresting, if this be admitted, to compare the canal which I propose by the isthmus of Panama with those projected on some different points. From the superficial explorations heretofore made on the isthmus, the number of points is reduced to two—the isthmus of Tehuantepec, in Mexico, and that of Nicaragua, in the State of Nicaragua, Central America.

The survey of these localities, though incomplete, principally that of the isthmus of Nicaragua, may, notwithstanding, help us to establish, in some respects, a comparison leading to the preference of any one of them.

1st. *Isthmus of Tehuantepec.*—The breadth of the isthmus, from the mouth of the Guasacoalco, on the Atlantic, to the shores of the Gulf of Tehuantepec, on the Pacific, is of 220 kilometres; the main ridge, which, as it is always the case along the whole extent of North and South America, draws nearer to the Pacific than to the Atlantic, presents a depression extending from Santa Maria Petapa to San Miguel Chimalapa. For a distance of about forty kilometres, its crest is lowered into an extensive table land, (Mesa de Tarifa,) the waters of which run towards the north, being bounded on the south and southeast by a chain of small round hills, distinguished with the name of Cerros de Masahua y de Espinosa, which divide the waters of the northern and southern slopes, affording some passes, as the Portillo de la Chivela, and the Portillo de Tarifa. The waters running from this depression of the main ridge, towards the north, flow into the Guasacoalco, and on the south into the Chicapa, which empties itself in the large lagoons east of Tehuantepec. It has been projected to adapt both these rivers, or one of them, for a communication between the two oceans, uniting them by means of a canal, a railroad, or even a turnpike road.

Don Agustin Cramer having explored it in 1774, by order of the Viceroy Frai Don Antonio Maria Bucareli, proposed this junction by means of a canal fed by the waters of the brooks Almoloya and Citune, tributaries of the Guasacoalco, running near Santa Maria Petapa. In 1825, the government of Mexico entrusted General Orbegoso with a similar mission; but the results of this survey were far different from those of Don Augustin Cramer. Owing, no doubt, to the deficiency of the only barometer which he possessed, and which, of course, exaggerated the elevation of the points surveyed by him, General Orbegoso stated that the construction of a canal was a problematic and gigantic enterprise, and merely advised the construction of a good road between Tehuantepec and the Guasacoalco. Finally, Don José de Garay having obtained, t h a decree of the Mexican government, issued on the 1st of

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March, 1842, the privilege of opening a means of communication across the isthmus, he sent to the isthmus a commission, under the superintendence of the engineer Don Cayetano Moro, for the purpose of making a scientific survey. This commission entered on duty on the 30th of April of the same year, and the results of their labors were published in 1844. They afforded certain and reliable data, from which I have made the following extract:

Tarifa, after which the great table land situated at the point of depression of the main ridge has been called, is 208.50 metres above the level of the sea; the table land itself is some metres lower. The small ridge which borders the table land on the south and southeast, dividing it from the southern slope, is of inconsiderable altitude. An excavation of some score metres would facilitate the egress of the waters of the table land towards the south through the Portillo de Tarifa. The *Cerro del Convento*, forming part of this ridge, and on which the *Rio Monetxa* takes its source, flowing afterwards into the Chicapa at San Miguel, is isolated, and affords on both its sides, but especially on the north, passes so inconsiderable in elevation that a cutting would prove of very trifling execution. The distance in a straight line between Tarifa and the *Bocabarra*, through which the lagoons bordering the southern coast of the isthmus are connected with the ocean, is of 60 kilometres. On the southern slope, the principal streams are the *Rio Ostuta* and the *Rio Chicapa*, both flowing in the lagoons; the latter 30 kilometres from the Bocabarra, and 37 from Tarifa. All the streams of the northern slope are tributaries of the Guazacoalco, which, after many windings, reaches the Gulf of Mexico, 166 kilometres from Tarifa; the Malatengo, one of its principal affluents, empties into it on its left bank, at a distance from its mouth of 130 kilometres in a straight line, and of 260 kilometres, following the sinuosities of its channel. The Chicapa, which has been gauged above San Miguel Chimalapa, after receiving several streams running from the main ridge, rolls a volume of water estimated, at a minimum, of seven cubic metres per second. The village of San Miguel, situated 35 kilometres from the lagoons, is 119 metres above the level of the sea.* The river Ostuta has a volume of water 5 or 6 times more considerable, and remarkably enough, it lessens as it recedes from its source; probably owing to the great porosity of the soil.

The Guazacoalco rolls a considerable volume of water in its lower part; it would be navigable for vessels of all dimensions were it not for the bar obstructing its entrance. The depth of water assigned to this bar is—

By *Dampier*—14 English feet	4.20	metres.
Cramer—18 Spanish feet at middle tide	5.20	"
Orbegoso—14 Spanish feet	6.60	"
Robinson—22 English feet	6.20	"
The last commission	6.20	"

* According to General Orbegoso, the Chicapa at San Miguel is dry during one-third of the year.

The engineer, Mr. Moro, explains this difference by the existence of several channels in the bar, the sounding having been made in different ones.

At 55 kilometres from its mouth, at a place called the *Horqueta*, the Guazacoalco divides into two branches of which the principal one on the right hand, called *Apotzongo*, is 40 kilometres long, and the other on the left, called the Mistan, 55 kilometres; they enclose a vast island called *Tecamichapa*. Above this island the water is always more than 7 metres deep, and at times even 12; but, above the junction of the two branches, some shoals are seen which in the opinion of Mr. Moro, might be easily removed by damming the Mistan at the place called the Horqueta. Above this point it decreases in depth, although in some places it has 8 or 10 metres water; but generally speaking it is below 7 metres, and sometimes goes down to 2.50 metres and 1.70 metres. Only two points would offer any difficulties—the *Mal Paso Viejo* and the actual *Mal Paso*; the former situated 5,000 metres below the confluence of the Malatengo, and the latter 15,000 metres below the first, on the confluence of the Rio Sarabia. On both these points the rocky bed of the river would greatly impede the deepening of its channel.

On the coast of the Pacific ocean the Bocabarra, which connects the sea with the lagoons into which the Chicapa and the Ostuta empty their waters, has a depth of from 8 to 7.5 metres; but this opening is totally obstructed in its inner part by a bar having but 2.50 metres waters. Mr. Moro attributes in a great measure the formation of this bar to the fact that the Tehuantepec formerly flowed into the lagoon, and has reason to believe that should it be removed by artificial means, the river would always follow its newly opened channel.

He is, besides, of opinion that this result would be aided by diverting from the upper Ostuta a portion of its waters, in order to supply the canal, thereby diminishing the force of the currents entering the lagoons. Beyond the bar there is a greater depth of water; but on a distance of at least 30 kilometres, which divide it from the mouth of the Chicapa, there is never more than 6 metres, and nearer to the shore but 4 to 2.

The project of a communication submitted by Mr. Moro, consists in connecting the Guazacoalco, rendered navigable as far as its confluence with the Malatengo with the lagoons on the shores of the Pacific, by means of a summit level canal having the transversal dimensions of the Caledonian canal; its summit level would be located at Tarifa, 200 metres above the level of the sea, to be supplied by means of the lateral canal starting from the Rio Chicapa, at a point called *Ultimo Rancho*, 11 kilometres above San Miguel; a second lateral canal, situated on a much higher level, would take into the Chicapa the waters of the Rio Ostuta, so as to draw to the dividing ridge of the canal the united waters of these streams. According to the above estimate, a considerable volume of water would thus be obtained of from 30 to 40 cubic metres per second, to be used not only for the supply of the canal, but also to aug-

sent the waters of the rivers which it might be deemed advisable to render navigable; these supplying canals are thus converted into real canals, for Mr. Moro assigns to them a section of 40 square metres.

From the dividing ridge, the canal would then descend on each of the two slopes, availing itself as far as possible of the beds of actual streams; on the northern slope of the Rio de Tarifa, the Chichina and the Malatengo, and on the southern one of the Rio Monotza and the Chicapa. The extent of the canal, according to this plan, is estimated at 80 kilometres, and that of the lateral canals at 30, of which 5 are between the Ostuta and the Chicapa, and 25 between the Chicapa and Tarifa.

Upon these premises, and taking as a criterion the cost of the Caledonian canal, the locks of which have cost 200,000 francs each, and the whole work that of 475,000 francs per kilometre, Mr. Moro makes the following estimate of cost for the junction of the two oceans, by means of a navigable route; taking for granted that wages are as low in Mexico as they are in Scotland, which, at least, is doubtful.

	Francs.
150 locks, at 200,000 francs	30,000,000
80 kilometres of canal, at 475,000 francs	38,000,000
25 kilometres of lateral canal, at 10 francs the cubic metres, otherwise 400 francs the running metre	10,000,000
5 kilometres lateral canal, at 15 francs the cubic metre, or 600 francs the running metre	3,000,000
Regulation and amelioration of the Guazacoalco, the the lagoons, and the Bocabarra	4,000,000
Total	85,000,000

Though unwilling to object to Mr. Moro's estimate, I cannot but notice the enormous difference therein between the cost of the canal, which is of 475 francs per metre, and that of the lateral and supplying canals, which is from 400 to 600 francs. The cost of 10 and 15 francs the cubic metre, at which the supplying canals have been estimated, seems to me very exaggerated, unless they be altogether excavated in the rocks, which is not likely to be the case. However, even if we admit this estimate, it is not the sum of 85 millions which is to be compared to the estimate cost of the canal at Panama, but the amount of cost in the construction of a canal at Tehuantepec having the dimensions of the canal I have proposed for Panama. This approximate calculation I am now going to make, taking as a basis the data with which we have been furnished by the survey of the commission under the supervision of Mr. Moro.

1. *Embankments.*—The dimensions of the canal which I propose are greater than those of the Caledonian canal, for which reason the same estimate cannot be made for both, the more so as the Caledonian canal has a lake for its summit level, whereas on either that of Panama or of Tehuantepec the crest of a ridge has to be

surmounted. In the project which I present, the embankment, after deducting the works on the summit level, cost 400 francs per running metre between Panama and the river Chagres; at Tehuantepec, the table land of Tarifa, which would constitute the dividing ridge of the canal, is somewhat lower than the huts situated 208.50 metres above the ocean; admitting its level to be 5 metres lower, or at 203.50 metres, the trench to be opened would have a depth of 10.50 metres above the bottom of the canal, corresponding to a cross section of 416.58 square metres. Estimating the cubic metre at 1.50 franc, and not at 10 francs, as Mr. Moro calculates the cost of his supplying canals, the expense per running metre would be of 624.87 francs. The distance from the Rio de Tarifa to the Cerro del Convento, on which the Monetza takes its rise, is 7,500 metres, (according to the map of Mr. Moro;) the summit level alone would cost, therefore, 4,686,525 francs, not including the greater elevation of the small ridge separating the two slopes. The total length of the proposed canal, between the mouth of the Chicapa, in the lagoons, and the confluence of the Malatengo, on the Guazacoalco, seems to be, on the other hand, not of 80, but of 95 kilometres, at least. For both these reasons, I think that the mean cost of 475 francs per metre cannot be estimated for a canal like that proposed by Mr. Moro; even though admitting an extent of but 90 kilometres, I would underrate the cost, putting it down at 500 francs per running metre, or 45,000,000 francs.

2. *The locks.*—The mean cost of the locks, as deduced from the general expenses of the Caledonian canal, seems to me still less applicable to those of the Tehuantepec canal. The Caledonian canal has several groups of contiguous locks; the famous stairs of Neptune present eight of them, which, altogether, regain a fall of 18.29 metres. This system, though having the inconvenience of a greater consumption of water, affords, on the other hand, the advantage of economy of expense. So on the eight locks of the Neptune there are but 9 flood gates, whereas there would be 16, were the locks isolated. By saving a flood gate, some extent of masonry is also saved. It is not, then, the mean cost of the locks of the Caledonian canal which should be considered, but that of an isolated lock.

I have estimated the locks of the canal of Panama at 600,000 francs; according to Mr. Chevalier, such locks would cost 400,000 francs at Brest. Is it to be imagined that they would be cheaper in Mexico? The reverse is rather to be presumed, for several locks are to be constructed in the bed of the river, entailing such increase of expense, that the entrance lock of the great floating dock at Cherbourg has cost nearly a million of francs. Let us admit, however, the sum of 400,000 francs for each lock. Mr. Moro calculates the number of locks at 150; in order to regain a total difference of level of 400 metres, with falls 3 metres high, 134 locks would be required. However, I am not of opinion that there should be fewer than 150, for, as several of these locks must be constructed to facilitate the navigation of rivers, it might not always be possible to locate them at a sufficient distance from

each other to give them a fall of 3 metres, 150 locks, at 400,000 francs, would cost 60,000,000 francs.

3. *Regulation and improvement of the Guazacoalco, the lagoons, and the Boccabarra.*—Mr. Moro appropriates for this object the sum of 4,000,000 francs. These numbers would increase very much by adopting for the canal a draught of 7 metres water, instead of 6.10 metres of the Caledonian canal.

On an extent of 28,000 metres, separating in the lagoons the Boccabarra from the mouth of the Rio Chicapa, the maximum depth of water is of 6 metres; it is generally 5.50; in some places it is but 4 metres, and on the inner bar of only 2.50 metres. Admitting a mean depth of 5.50 metres, to obtain a depth of 7.50 metres, (for in so vast a lake a greater one would be required than in tranquil waters,) 2 metres would have to be drained; on an extent of 100 metres, it would give 200 cubic metres per running metre, which, at the cost of 2 francs per cubic metre, as estimated in the canal of Panama, would carry the expense to 400 francs, or 11,200,000 francs for the 28 kilometres.

The Guazacoalco, from the confluence of the Malatengo to Penablanca, on an extent of about 115 kilometres, has less than 7 metres water, generally 5 metres. On its upper part it has but 4 and 3 metres, and is even as low as 1.70 in some places. It would then be necessary, in order to have 7 metres water everywhere, to excavate 3 metres on an average, which would give, on a breadth of 60 metres, 150 cubic metres, at 300 francs. The deepening of these 115 kilometres would then cost 34,500,000 francs.

By recapitulating these different numbers, we find that the canal of Tehuantepec, excavated on the same dimensions which I have assigned to that of Panama, would cost:

	Francs.
1. Embankments, 80 kilometres at 500fr.....	45,000,000
2. Locks: 150, at 400,000fr.....	60,000,000
3. Deepening of the lagoons.....	11,200,000
Deepening of the Guazacoalco.....	34,500,000
4. Lateral canals, 30 kilometers at 25fr.....	750,000
Total.....	251,450,000

That is to say, 21 millions more than that of Panama, the locks of which are nevertheless estimated at 600,000 francs or 200,000 francs higher than those of Tehuantepec.

By comparing these numbers, I am constrained to come to a conclusion quite opposite from that of M. Moro, and to view the plan of a route through Panama as far superior to that of Tehuantepec, over which it has moreover the advantage of a smaller extent, being only 76,540 metres, whereas that of Tehuantepec is 378 kilometres, or five times as much.

The insalubrity of the isthmus of Panama has been adduced against the adoption of that route, whilst that of Tehuantepec is represented as admirably healthy. Is it reasonable, however, to apply to the shores of the two oceans, and especially to that of the

province of Vera Cruz, the observations made on the table lands of the interior? Are the borders of the Guasacoalcos, or the lagoons of Tehuantepec, as healthy as the plains of Tarifa? It is not very probable. Chagres is the only unhealthy spot on the line of Panama, though it is less so than it has been judged heretofore; and even this place is avoided in the project which I have submitted.

At Tehuantepec, the centigrade thermometer often ranges as high as 33 degrees at 7 in the morning, whilst I have seldom seen it at Panama above 32 degrees during the warmest part of the day. Besides, is the entrance of the Guasacoalco as accessible as the bay of Limon during the prevalence of the north wind, so common to the Gulf of Mexico? And does the neighborhood of Tehuantepec on the Pacific afford so safe and easy a navigation as the bottom of the gulf of Panama? These questions cannot be answered but in favor of the Panama route, furnishing further reasons for adopting this point with preference to the isthmus of Tehuantepec.

2.—*The isthmus of Nicaragua.*

We are not in possession of the accurate information with regard to the isthmus of Nicaragua which we have concerning the isthmus of Tehuantepec; all that has been done in the matter, or at least all that we know of, is condensed in the work of Mr. Michel Chevalier on the junction of the two oceans. I shall merely quote therefrom what I consider indispensable to establish a comparison.

The width of the isthmus, measured at the port of San Juan de Nicaragua, is of 150 kilometres; the centre of the isthmus is occupied by the great lake of Nicaragua, 176 kilometres long by 50 wide, and of a great depth of water. This lake, situated at 40 metres above the sea, empties the surplus of its waters into the Atlantic ocean through the river San Juan, which runs from west to east, and which, after a course of 146 kilometres, flows into the port of San Juan. Above the lake of Nicaragua is another smaller lake—that of Leon or Managua—63 kilometres long, 8.75 metres higher than the former, with which it connects by means of the river Tipitapa, 55 metres in length.

It is quite evident that the communication between the lakes and the Atlantic ocean can at any time be effected either by improving the course of the Rio San Juan, or by excavating a lateral canal. The main difficulty then consists in traversing the ridge which divides them from the Pacific. This ridge is in some places considerably depressed; it even seems completely to vanish between the extremity of the lake of Leon and the port of Realejo.

Levels have been taken through the ridge on two directions. The greatest altitude of the line pursued at the end of the last century by Don Manuel Galisteo, from the borders of the lake, near the town of Nicaragua, to the gulf of Papagayo, was ascertained to be 43.70 metres above the lake, and consequently 83.70

metres above the ocean, 9,300 metres from the lake, the latter being 37,302 metres from the ocean.

Mr. Bailey, an officer in the English navy, afterwards explored another line, starting also from the vicinity of the town of Managua, and terminating on the river San Juan del Sur, not far from its mouth. He found the lake to be 39.11 metres above the ocean, the culminating point 148.67 above the lake, and 6,211 metres from the ocean, distant itself 25,935 metres from the lake.

On the first line, a trench might be excavated on a level with the lake; its maximum elevation would be of 50.70, which it would only attain on a short space; it would only be above 40 metres on an extent of less than 1,000 metres. But its total length would be considerable, for it would probably exceed 18,000 metres; applying to these dimensions the numbers on which I have based the estimate for the canal at Panama, we find that, for a mean height of 25 metres, the cube of the excavations per running metre would be 720 metres, which, at the cost of 7fr. 50c. per cubic metre, would involve an expense of 5,400fr., or 97,200,000fr. for 18 kilometres, an immense sum, to which we should add, moreover, the expenses for the canal on the southern slope, for the improvement of the Rio San Juan, perhaps the construction of a lateral canal, and the indispensable works on the two extreme ports.

It can now be seen that this route cannot compare to that of Panama. In order to lessen the cost, the summit level should be raised; but then the difficulty would occur of supplying this upper part of the canal, for nothing in the surveys made heretofore seems to indicate how water is to be obtained at a greater altitude. Neither can the lake of Leon be made available, which is only 8.75 metres higher, (an elevation of three locks,) for the length of the supplying canal would be of at least 120 kilometres, requiring in a declivity of 0.0001 a total fall of 12 metres.

Mr. Stephens presented the project of a canal for the route surveyed by Mr. Bailey, by means of successive locks 22.49 metres above the lake, then to descend again to the side of the South sea, at an altitude of 61 metres. Two-thirds of the summit level, 4,800 metres long, were established by means of a tunnel. But as nothing seems to indicate in that region the existence of a sufficient quantity of water for the supply of the canal at such an elevation, it would always be advisable in a good plan to place the summit level on a level with the lake; then the tunnel would at least be 6,000 metres long, and would be preceded by trenches having an aggregate length of at least 15,000 metres. These works would cost, according to the estimate for the canal of Panama:

6,000 metres tunnel, at 6,700 francs.....	33,500,000 fr.
15,000 metres trench, 20 metres in average height, 670 square metres in section, at 7fr. 50c. the cubic metre; 4,275fr. the running metre; in all	64,125,000 fr.
Total.....	97,625,000 fr.

We may, therefore, calculate that the expenses would be the same with regard to the two routes, though that of Don Manuel Galisteo would have the advantage over the other of being in the open ground. Nevertheless, neither of them seems to stand a comparison with the route by the isthmus of Panama, for, to the expense of 97,625,000, the following should be added:

	Francs.
28 locks, 14 on each slope, at 500,000fr.	14,000,000
About 6,000 metres canal to be excavated on the southern slope, at 400fr. per metre	2,400,000
Improvement of the river San Juan, on 146 kilometres, at 200fr. per metre, (supposing that it would be unnecessary to excavate a canal parallel to the river, which would cost double,)*	29,200,000
Works to be excavated at the extreme ports	5,000,000
Total cost	148,225,000

Then it should be taken into consideration that the total length of the navigable line would be of 295 kilometres instead of 76,[illegible] metres, as at Panama.

We are wanting in accurate information with regard to the country situated between the lakes and the Pacific ocean; notwithstanding, all the travellers who have explored those regions agree in representing the soil between the lake of Leon and the coast of Realejo as entirely flat; it is even stated in a description of Central America and Mexico, published at Boston in 1833, that the altitude of the highest spot between lake Leon and the Pacific ocean is only 15.55 metres above the lake, and that the distance from the lake to the river Torta, which flows into the South sea at a place but 91 centimetres above its level, is only of 11 kilometres.

It is to be doubted whether we can place implicit confidence in these statements; but should they be correct, this point would undoubtedly be the most advantageous for the opening of a communication between the two oceans. The line of navigation would then be of 495 kilometres, but this inconvenience would be fully compensated by the advantages of an ample and certain supply of water, by means of those great lakes, on which towage by steam power could be established on an extent of 240 kilometres—an advantage not to be obtained in a narrow canal.

In spite of that diffidence to which we are led through the exaggerated accounts connected with the isthmus, it might be advisable, before adopting any particular point, to cause accurate levellings to be taken in the space comprised between lake Leon and the Pacific, and the entire line of the river San Juan, so as to determine with precision the works which should be executed, and arrive at a conclusion with regard to its estimate of cost; until then, no decision can be taken with full knowledge of the subject, as to which is to be preferred, the isthmus of Panama or that of Nicaragua.

* Mr. Stephens estimates the cost of this work at about 60 million francs.

Railroad across the isthmus.

I have already examined (chap. 2) the advantages accruing to commerce from a railroad across the isthmus. This means of communication would always be disadvantageous, inasmuch as it would require a double transhipment, which would be so adverse to commerce that, in many instances, Cape Horn would be preferred. The construction of a railroad would doubtless be acceptable to the inhabitants of the isthmus, wanting, as they do, a good road from Chagres to Panama; but its subserviency to the commerce of Europe would be null at the present period, and would remain so until some important change would take place in the habitual commercial intercourse of nations; for it is not the expense, but the transhipment of merchandise which would keep vessels from resorting to Chagres and Panama, and still more the necessity of acquiring relations in a country almost destitute of commerce.

However, as there is a diversity of opinion on this subject, I have thought it best to examine it also in this point of view.

On a railroad across the isthmus, either engines or horses might be employed for locomotion—two systems, which would be based on different plans, and which, consequently, would occasion a difference of expense; but whichever of them should be adopted, it would be always necessary to form, at each of the extremities of the road, a harbor, sufficiently capacious to receive vessels of large tonnage, and which might at the same time facilitate transhipment, rendering them as few as possible. With regard to the route, I have surveyed it on the hypothesis that engines are to be employed for locomotion.

The route which I suggest would differ very little from that of the canal, as it would only deviate from it in the lower part of the northern slope, where the canal follows the bed of the river Chagres, and in the vicinity of the summit of the main ridge, between the Rio Copé on the southern slope, and the Caño Quebrado on the northern slope, in the channel of the Rio Bonito.

In the latter region it would follow the right bank, at a certain distance from the stream, so as to avoid the considerable embankments required by the great declivity of the bed of the river, the falls of which can be regained in the project of the canal, by means of grouped locks, but which, with regard to a railroad, can only be so by means of a uniform declivity.

The culminating point of the route is established 60 metres above the high tides of the Pacific. The main ridge is traversed by means of a tunnel which, though established on a level higher than that of the canal, would nevertheless be longer, owing to the smaller elevation of the trenches which precede it. The entrance of this tunnel on the northern slope is located at the confluence of the Lirio and the Paja rivers. It is 6,050 metres long; the tunnel would only be 6,350 metres.

From this tunnel the declivities of the railroad are the following:

	Length.	Declivity.	Total fall.
	Met.	Met.	Met.
1° SOUTHERN SLOPE.			
Tunnel 6m.050 long	750	0.00	0.00
	5,300	0.003	15.00
	200	0.005	0.90
Between the tunnel and the river Copé	1,940	0.0060	10.30
Prairies of the Bernardino	3,000	0.006	18.00
Passage of the Aguacate	5,500	0.00	0.00
Between the Rio Aguacate and the bay of Vaca de Monte	3,500	0.0014	5.00
Level	100	0.00	0.00
Total	20,290		49.00
2° SOUTHERN SLOPE.			
Level stair case	500	0.00	0.00
Valley of the Rio Bonito	10,000	0.004	40.00
Passage of the Cano Quebrado	1,600	0.0025	4.00
A reporter	12,100		44.00

Levels.	Curves. Development. To the right.	Curves. Development. To the left.	Curves. Radius.	Observations.
Met.	Met.	Met.	Met.	
5,300				The entrance of the tunnel, situated at the mouth of the Rio Lirio, is in the classification (à la cote) 60 metres.
1,825				
	250		1,000	Embankment 10m.80 maximum height.
2,765				
		290	3,000	
2,960				
	540		2,000	Embankment four metres high.
260				
		1,200	1,000	
1,780				
		140	1,000	
1,250				The railroad in the bay of Vaca de Monte is in the classification (la cote) 2 metres.
17,870	790	1,630		
	20,290 metres.			
100				The classification (la cote) of the stair case situated at the southern extremity of the tunnel is 60 m.
	150		1,000	
250				
1,510				
	730		1,000	
880				
		1,320	1,000	The largest excavation is twelve metres deep.
2,260				
	350		1,000	The largest embankment is 6m.80.
630				
		1,440	1,000	
1,190				
	1,050		1,000	Embankment 6m.50.
850				
7,060	2,330	2,760		

	Length.	Declivity.	Total fall.
	Met.	Met.	Met.
Report	13,100	.....	44.00
Tunnel between the Cabo Quebrado and the Rio Gigante	3,400	0.000	0.00
On a level			
Basin of the Rio Gigante			
Palenquilla. Barro Colorado	6,000	0.0005	3.00
Basin of the Chagres	4,000	0.0018	7.20
	7,000	0.0008	5.80
On a level			
Passage of the Trinidad on a bridge, 45 metres			
Crossing of the Chagres, in three points, on bridges, 70 metres	11,000	0.000	0.00
Passage of the Rio Gatun, on a bridge, 35 metres			
	2,000	0.003	6.00
	4,000	0.0025	10.00
Between the Rio Gatun and the bay of Limon	4,400	0.000	0.00
Total	53,900	.....	64.00
Recapitulation: Southern slope	20,290	.....	.....
Northern slope	53,900	.....	.....
Total	74,180	.....	.....

Levels.	Curves. Development. To the right.	Curves. Development. To the left.	Curves. Radius.	Observations.
Met.	Met.	Met.	Met.	
7,060	2,350	2,760		
590				
	390		1,000	
690				Trench 15 metres high.
	930		1,000	
110				
		1,270	1,000	
1,470				The elevation of the largest trench is 22 metres; that of the largest embankment 5m.50.
	1,730		1,000	
1,530				
		1,320	750	
2,060				
		1,490	1,000	
200				
	1,310		1,000	
2,480				
		940	2,000	
980				
	1,730		3,000	
1,700				
	2,400		2,000	
2,470				
	1,020		1,000	Embankments from 4m.20 to 5m.00.
250				
	470		1,000	
550				
		1,750	1,000	
2,160				
		1,810	2,000	Excavation of 7m.80.
2,210				
	790		1,000	
1,550				
	730		1,000	The railroad is at the bay of Limon, in the classification (à la cote) —4.0, that is to say, 2m.20 above the low tides of the Atlantic.
310				
39,770	13,780	11,350		
	53,900 mèt.			
17,870	790	1,630		
39,770	13,780	11,350		
48,640	14,570	12,980		
	74,190 mèt.			

On a line 74,190 metres long, whilst that of navigation would be 76,450, the railroad must cross the rivers Trinidad, Gatun and Chagres, besides those streams traversed by the canal by means of very costly viaducts. The passage of the Chagres on three different points requires bridges with an opening of 70 metres, which may be obtained by four arches of 18 metres. The opening of the bridges over the rivers Trinidad and Gatun is of, but from 35 to 45 metres, and consequently only requires two or three arches of from 15 to 18 metres. The Rio Trinidad will be crossed at 600 metres from its mouth; the passages of the Chagres will take place—the first at La Bruja, the second 800 metres below, and the third at Miraflores; finally, that of the river Gatun will be located 150 metres above its confluence with the Chagres.

Estimate of cost—double track—one track through tunnel.

For a tunnel 19 feet 8 inches wide, and 18 feet high, at $2 29 per cubic yard, equal to $90 04 per running yard—	
Length of tunnel, 6,616 yards, at $90 04	$595,704 64
Grading, largely estimated as averaging 16.40 feet, with a cross section of 760 square feet, at $0 23 per cubic yard, 6,200,000 cubic yards, at 23 cents	1,430,600 00
Three viaducts across the Chagres, each of 230 feet, at $40,000	120,000 00
One viaduct across at Trinidad, 148 feet long	30,000 00
One viaduct across at Gatun, 115 feet long	24,000 00
Three viaducts, of one arch each, across the Aguacata, Copé, and Caño Quebrado, from 40 to 50 feet in length, at $10,000 apiece	30,000 00
Ten small bridges, at $30,000	30,000 00
Rails, (60 pounds to the yard,) superstructure, crossties, spikes, &c., &c., discharging cranes, &c.	1,575,280 00
Mole at Limon bay	1,013,600 00
Mole at Vaca de Monte bay	865,300 00
Locomotives, wagons, cars, &c., &c.	400,000 00
Storehouses, shops, stopping places, &c., &c.	380,000 00
Entire cost of railroad	$6,494,484 64

It will be remarked that these expenses are by far inferior to those required for the construction of a canal, even should its dimensions be reduced to those necessary for the admission of vessels of 600 tons; besides, the railroad would have the great advantage of only requiring those works which, by their nature and dimensions, are classed among those executed everywhere; thus it could be within the reach of private enterprise. It cannot be denied that these are considerable advantages; but we should not look exclusively to them. It would be well, too, in order to appreciate the convenience of a new means of communication, to examine the advantages to be derived therefrom after its termination: in my opinion, that of a canal, admitting, if not all, the greater number,

at least, of sailing vessels, cannot be doubtful. We may also anticipate that, when there will be no necessity for making the dangerous voyage around Cape Horn, and the distances will be considerably shortened, the number, already small, of vessels measuring over 600 tons will be considerably reduced. As to the advantages which Europe would accrue from the construction of a railroad across the isthmus, they are to me very problematic, if not altogether null, for a long time to come; and this belief is founded not only on the necessity of changing the habits of commerce, and on the expenses originated by transhipment, although compensated by the shortness of voyages, but also on that of establishing commercial relations at Panama and Chagres, making of these ports two great centres of navigation, where merchandise would at all times find transportation, without losing in warehouses the time which would be saved with regard to the voyages.

The Conseil General des Ponts et Chaussées, before giving its opinion on the relative advantages of a canal and a railroad across the isthmus, has deemed it advisable to consult that of the boards of commerce of the ports of France. The views of those who will be called to avail themselves of this new route must undoubtedly have a great weight in the decision; however, we may now make an approximate estimate of the relative advantages afforded by a railroad and a canal, both to the commerce and to the constructors. I have proposed a toll of 10 francs per ton for the canal; to this we must add the towage, estimated at 5c. per ton and per kilometre, with a velocity of 5 kilometres per hour. This maximum is hardly ever attained. In some instances, especially in the canal du Midi, in France, the cost of towage is as low as 0.01fr. per ton and per kilometre. The velocity is inconsiderable, it is true, (244 kilometres in 8 days, or 30½ kilometres per day;) but, with regard to the isthmus, the advantages afforded by a canal would not be smaller for crossing it in three days, instead of two. The greatest velocity attained in towage by horse power is known to be 50 or 60 metres per minute, or 3,000 an hour; and, as the time lost in the passage of locks forms a considerable portion of the whole duration of the voyage, no great benefit would be derived by an increase of rapidity between the locks. I believe, therefore, that generally the sum of 0.05fr., above mentioned, will be considerably lowered, and that we may admit it to be of 0.03fr. or 1.50fr. towage on the whole line of navigation, and the total expense from one sea to the other of 11.50fr. per ton.

On a railroad the expense of towage is far greater, for a horse can only draw on a level one-fifth, at most, of the weight he would draw on a canal. To this expense would be added the repairs of the engines and of the road, the latter being more costly than those of a canal.

On a much frequented railroad, the traction effected by a locomotive is more economical than by horse power. A learned engineer, Mr. Julien, whose opinion on railroad matters is an authority, in a memoir on the railroads of Belgium, estimates the cost of traction, repairs, inspection, &c., at 0.06fr. per ton and per kilometre.

I will admit these numbers, although it might be supposed with some reason that the same perfection and advantageous results will not be obtained at Panama as in Belgium. The cost of traction for the whole line will then be 4.50fr. per ton; to which should be added—

1st. The cost of transhipment, which I estimate, as it is customary in some parts of France, at 1fr. per ton, (at some places, for instance Marseilles, these expenses are higher,) for two transhipments	2 fr.
2d. The warehouse duties, estimated at 0.50fr. at each extremity of the railroad	1 "
3d. The duties on commission, estimated at 1fr. at each port	2 "
Total per ton	5 "

So as to establish an equality between the cost on a railroad and a canal, the duties to be collected for the company should only be of..... 2 fr. per ton,
(Corresponding only to 0.027fr. per kilometre,)
which, added to the expense of traction, estimated at..... 4.50 "
And the duties of commission, warehousing, &c., estimated at..... 5.00 "
Represents a total expense of..... 11.50 "

Even in this hypothesis, there is a difference between them; for I have not mentioned the losses attending the mere transhipment. It is difficult to estimate them, for they principally depend on the nature of the merchandise—and, in several cases, are very considerable, as, for instance, in that of wines and other liquors, of coal, &c. Thus it is calculated that the losses attending the transportation of coal from the mines of Alais to Marseilles, by the railroad, and then by the Rhone and the sea, are equal to the cost of transportation.

According to the preceding estimate, as the railroad between the two oceans will cost 38,000,000 of francs, a clear income of 1,900,000 francs would be required in order that the company might draw an interest of 5 per cent on the capital invested. With regard to a canal on a smaller scale, by reducing the tonnage which is supposed to cross to 665,000, the annual revenue would represent an interest of 6¼ per cent on the capital invested.

In this point of view, the railroad cannot be compared to the canal. It is easy, moreover, to foresee that the number of 835,000 can never be attained. At present, the annual movement of vessels by the route across the isthmus of Panama has been estimated at 700,000 tons; but among these vessels there are some which, from the nature of their cargoes, would be constrained to adopt another route, if a transhipment would become necessary. Thus whalers, which represent 200,000 tons, would continue to pass by Cape

Rica. The voyages to China, which are made by the Cape of Good Hope, and which in the event of the isthmus being opened might take this route, though only for the voyage thither, owing to the constancy of the trade winds and the tranquility of the sea, will always continue in the same route so long as a transhipment will be indispensable.

Vessels trading with China actually gauge 60,000 tons. A deduction of at least 260,000 tons should therefore be made from the 700,000 afore mentioned. The railroad would only retain 440,000 tons, not mentioning the merchandise which is liable to suffer from transhipment, or from too long delays in the warehouses of Panama and Chagres.

In order that the company might receive a fair interest on the capital invested, the duties should be increased; and this would diminish the advantages to be derived from the passage, and, consequently, the number of tons.

Should it be desired to adopt a railroad in which the traction would be by means of horses, the primitive cost would be lower, but that of traction would be more considerable, so that the difference which I now point out would be more striking in favor of a canal.

I persist, therefore, in viewing a railroad across the isthmus as a work of mere local advantages, without any for commerce at large, and which will be moreover an obstacle to the execution of a canal, for the expenses required by the latter would augment, together with the indemnity, which must of course be paid to the owners of the road. The construction of a railroad would only produce one benefit: that of making the inhabitants of the isthmus acquainted with great public works, to induce workmen and mechanics to settle in the country, to make the latter better known, and to afford the means of making an accurate estimate of the costs of a canal. But all these ends might be attained by means of a less considerable work; as, for instance, a macadamized road, carefully constructed, terminating on each ocean, in ports where safe and easy means of lading and unlading might be found.

With regard to passengers, and even merchandise, should any cross the isthmus, would it be advantageous to traverse with a considerable velocity the 75 kilometres which separate the two oceans, even should it take eight or ten hours for travellers to make this distance, instead of four by a railroad? Should goods employ two or three days, instead of five hours? would the total duration of a two months' voyage be considerably changed? Not at all. If, then, a perfect means of communication would be desired, and a good road deemed insufficient, it seems to me that the best course to pursue would be to abandon the roads conducted on the principle of great velocity and steam locomotives, and adopt the opinion of those who desire a railroad only worked by horses. There would be then no necessity to abide by slow declivities, those extensive curves which render the embankments so costly, those enormous rails required by locomotives, weighing from eighteen to twenty tons. The foregoing estimate of cost might then be reduced.

By ascending the Rio Copé as far as 3,000 metres from the Paja mountain, and thence taking the direction of the Rio Paja, 2,500 metres above the confluence of the Rio Lirio, the length might be reduced by establishing the tunnel in the classification 80 on the northern slope, and in the classification 77 on the southern one. At the same time the section might be restricted, for then it would be unnecessary to give it an elevation of 5.50 metres, required by the height of the chimneys of the locomotives. Thus, in this respect, an economy might be attained of 1,500,000 francs; on the embankments 3,000,000, at least, might be saved.

As to the superstructure, an expense of only sixty francs per running metre would be incurred, if, instead of rails, sleepers be substituted, on which bands of iron be nailed. An economy of three millions five hundred thousand francs would attend this process.

The approximate cost of such a road would be at least ten millions of francs less than a road with steam power, and the total expense would not be above twenty-three millions.

In fine, the object which should be kept in view in the junction of the two oceans is the passage of vessels across the isthmus, and the transport of merchandise without requiring a transhipment. This cannot be attained but by means of a great maritime canal. As to the dimensions which should be assigned to it, I willingly adhere to the opinion of those who deem as sufficient such dimensions as would admit vessels measuring 600 tons. Any other route constructed on this point can only be of inconsiderable benefit to commerce, if not altogether useless.

If, then, the project of a canal is abandoned, or even postponed, I believe that a work establishing a communication between the two oceans at the lowest cost, and in the shortest time, should have the preference. If this be admitted, I am unhesitatingly in favor of a macadamized road.

ERRATA.—Page 494, last line.

The Castilian, or judicial vara of Spain.—5,000 of them make a league, and are equal in length to 4,635 English yards. (See case of Mitchell et al. *vs.* United States, Peters's Reports of the Supreme Court of the United States, vol. xv., page 87. [Translator.

THE CANAL OF NICARAGUA.

CHAPTER I.

Importance of the geographical situation of the State of Nicaragua, and the line of country through which the canal is to be cut.

The junction of the Atlantic and Pacific oceans by means of a canal crossing the centre of the new world, is a question of acknowledged importance. It will diminish, by three thousand miles, the distance that separates Europe from the whole of the western coast of America and Oceania; it will render the communications with China, Japan, New Zealand, and New Holland speedy and easy, by means of steamboats; it will elevate immediately to a prodigious degree of prosperity those countries through which such an undertaking must draw annually, two or three thousand merchantmen; it will open new channels to the introduction of European produce; in a word, it will advance, by several centuries, the progress of Christianity and civilization throughout the half of the globe.

This undertaking is alike favorable to the interests of humanity generally, and of America in particular. This being conceded, it remains to determine under what conditions a ship canal is best calculated to develop European commerce and the prosperity of Central America; if we prove that there is but one particular route which can satisfy at once these two-fold interests, and that this route presents the fewest difficulties and requires the least expense, we shall have considerably simplified the problem.

Central America may be considered as a great isthmus which separates the Atlantic and Pacific oceans, beginning at the isthmus of Tehuantepec and finishing at the gulf of Darien.—(*See the maps, Nos.* I *and* II.) The extent of its coasts is about 1,200 miles; its superfices measures 26,650 square leagues—nearly as large as that of the French territory; its population is three millions. The natives derive their origin from the ancient Spaniards and Ladinos, as well as from the original Indians; and there are no slaves. The north of Central America belongs to Mexico, the southern part belongs to New Grenada, and the centre forms the republic of Guatemala, which in 1823 constituted itself in a federal form, composed of five States—Costa Rica, Guatemala, Honduras, Nicaragua, and St. Salvador. At present, these States are independent of one another, but in their diplomatic relations, Honduras, St. Salvador, and Nicaragua act with the same understanding. According to Thompson and Montgomery, extensive tracts of land,

having a beautiful climate, advantageously situated, and possessing a most extraordinary fertility, are still uninhabited, and entirely left to themselves. There are also immense forests, the working of which will yield immense profits to any active persons who will undertake to do so. Such is the fertility of the soil that they can raise three crops of every kind of corn in one year, especially of maize, which produces from one hundred to five hundred for one. All the productions of hot and temperate climates prosper in it. The temperature is as diversified as the surface of the country; the coasts and low grounds which are near the sea have the benefit of the tropical heat, whilst on the heights and inland we find a perpetual spring. The production of fruits, as well as crops of every kind, takes place without any interruption. In the plains and valleys the soil is formed of *alluvial* matter five or six feet deep; it is rich enough to serve as manure to less fertile lands. (*For additional particulars, see appendix No.* 1.)

It is in this part of the *American* continent, that five principal points have been proposed as eligible for the opening of a communication between the two seas. The first, on the northern side of Central America, on the Mexican territory, through the isthmus of Tehuantepec; the second, through the isthmus of Nicaragua; the third, through the isthmus of Panama; and, finally, two other projects, through the gulf of Darien. (*See the map No.* 11.)

Of these, the passage through the isthmus of Tehuantepec presents, according to the surveys of General Orbegoso, almost insuperable difficulties. According to Mr. Moro, these difficulties appear to be surmountable, but at an immense expense; for, although his estimate is but 3,334,000 pounds sterling, still, if we give to his surveys the valuation of Mr. Garella, the engineer directed by the French government to make the survey through the isthmus of Panama, we find the whole amount to be nearly 8,000,000 pounds sterling.* Moreover, this canal would have the immense disadvantage of opening into the gulf of Mexico, dangerous to navigation, and also of lengthening, by several hundred miles, the route to South America, besides which, the ports situated at the two ends of the canal would not be so good as those through Nicaragua, the country itself presenting no such advantage of colonization or chance of prosperity. The opinions collected by Mr. Michel Chevalier are quite unfavorable to the adoption of the two proposed routes through the gulf of Darien.

There remains only two available projects—one by the isthmus of Panama, the other by the river San Juan and the lakes of the

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* First, for earth works, 90 kilom. at 500 francs..... Francs. 45,000,000
Second, 150 locks, at 600,000 francs each..... 90,000,000
Third, deepening of marshes..... 11,000,000
Fourth, deepening of the Guazacoalco..... 34,500,000
Fifth, ditches, 90 kilom., at 25 francs..... 750,000
181,250,000

Or, £8,000,000 sterling.

State of Nicaragua. Now, even if the whole of the above mentioned projects were available, we maintain that the last stated is the only one that should be adopted, inasmuch as it is the only one conducive to the real interests of Central America and the world at large. A few preliminary observations will elucidate our position.

There are certain countries which, from their geographical situation, are destined to a highly prosperous future; wealth, power—every national advantage flows into them; provided, that where nature has done her utmost man does not neglect to avail himself of her beneficent assistance.

Those countries are in the most favorable conditions which are situated on the high road of commerce, and which offer to commerce the safest ports and harbors, as well as the most profitable interchange of commodities; such countries finding in the intercourse of foreign trade illimitable resources, are enabled to take advantage of the fertility of their soil, and in this way a home trade springs up, commensurate with the increase of mercantile traffic. It is by such means that Tyre, Carthage, Constantinople, Venice, Genoa, Amsterdam, Liverpool, and London attained to such great prosperity—rising from the condition of poor hamlets to extensive and affluent commercial cities, and exhibiting to surrounding nations the astonishing spectacle of powerful states springing suddenly from unwholesome swamps and marshes. Venice, in particular, was indebted for her overwhelming grandeur to the geographical position which constituted her for centuries the entrepot between Europe and the east; and it was only when the discovery of the Cape of Good Hope opened a ship passage to the latter that her prosperity gradually declined. Notwithstanding, so great was her accumulation of wealth and consequent commercial influence, that she withstood for three centuries the formidable competition thus created.

There exists another city famous in history, although now fallen from its pristine grandeur, so admirably situated as to excite the jealousy of all the great European powers, who combine to maintain in it a government so far barbarous as to be incapable of taking advantage of the great resources bestowed upon it by nature. The geographical position of Constantinople is such as rendered her the queen of the ancient world; occupying, as she does, the central point between Europe, Asia, and Africa, she could become the entrepot of the commerce of all these countries, and obtain over them an immense preponderance; for, in politics as in strategy, a central position always commands the circumference. Situated between two seas, of which, like two great lakes, she commands the entrance, she could shut up in them, sheltered from the assaults of all other nations, the most formidable fleets, by which she could exercise dominion in the Mediterranean as well as in the Black sea, thereby commanding the entrance of the Danube, which opens the way to Germany, as well as the sources of the Euphrates, which open the road to the Indies, dictating her own terms to the commerce of Greece, France, Italy, Spain, and Egypt; this is

what the proud city of Constantine could be, and this is what she is not, "because," as Montesquieu says, "God permitted that Turks should exist on earth, a people the most fit to possess uselessly a great empire.

There exists in the new world a state as admirably situated as Constantinople, and we must say, up to the present time, as uselessly occupied; we allude to the State of Nicaragua. (*See the map No. 3.*)

As Constantinople is the centre of the ancient world, so is the town of Leon, or rather Massaya, the centre of the new; and if the tongue of land which separates its two lakes from the Pacific ocean were cut through, she would command, by her central position, the entire coast of North and South America. Like Constantinople, Massaya is situated between two extensive natural harbors, capable of giving shelter to the largest fleets, safe from attack. The State of Nicaragua can become, better than Constantinople, the necessary route for the great commerce of the world, for it is for the United States the shortest road to China and the East Indies, and for England and the rest of Europe to New Holland, Polynesia, and the whole of the western coast of America. The State of Nicaragua is then destined to attain to an extraordinary degree of prosperity and grandeur, for that which renders its political position more advantageous than that of Constantinople is, that the great maritime powers of Europe would witness with pleasure, and not with jealousy, its attainment of a station no less favorable to its individual interests than to the commerce of the world.

France, England, Holland, Russia, and the United States have a great commercial interest in the establishment of a communication between the two oceans; but England has more than the other powers, a political interest in the execution of this project. England will see with pleasure Central America become a flourishing and powerful State, which will establish a balance of power, by creating in Spanish America a new centre of active enterprise, powerful enough to give rise to a great feeling of nationality, and to prevent, by backing Mexico, any further encroachment from the north. England will witness with satisfaction the opening of a route which will enable her to communicate speedily with Oregon, China, and her possessions in New Holland; she will find, in a word, that the advancement of Central America will renovate the declining commerce of Jamaica and the other English islands in the Antilles, the progressive decay of which will be thereby stopped. It is a happy coincidence that the political and commercial prosperity of the State of Nicaragua is closely connected with the policy of that nation which has the greatest preponderance on the sea.

To show the unparalleled importance which the State of Nicaragua would acquire if the junction of the two seas were carried through its territory, is at once to resolve the question of its necessity; but that which we are now called to examine is, whether that particular track would, in preference to that through Panama, more

fully meet all the exigencies conducive to the advantages which both Europe and America have a right to expect from so important an enterprise.

The proposed canal must not be a mere cutting, calculated to convey from one sea to the other European produce, simply; it must, above all, render Central America a maritime State—prosperous by the interchange of its internal produce, and powerful by its extensive commerce. To this intent, such a line of country should be adopted as would afford throughout its course, and especially at the extremities, the best harbors, and a confluence with the greatest number of rivers.

If a canal could be made across this territory of Central America, commencing at San Juan of Nicaragua, situated on the Caribbean sea, and ending at Realejo, on the Pacific, that canal would completely satisfy the required conditions, for Realejo is a good harbor, and San Juan offers a good roadstead, sheltered from the northeasterly winds, which are the only violent ones upon the coast. Neither at Panama, on the other hand, nor at Chagres, nor on any point of the same coast, is there any moorage to be compared with that just mentioned.

It is not sufficient that this canal should have at its extremities two good ports—it must possess, in addition, along its course, a succession of natural basins serving as docks, which would enable a large number of ships to load and discharge cargo with promptitude and safety.

At London, at Liverpool, at Venice, at Cherbourg, at Havre, at Antwerp, the various governments of Europe, during the last five centuries, have spent hundreds of millions in creating artificial reservoirs of only a few hundred yards of superficial extent, whilst at Leon and Grenada there are two natural basins, which furnish on a large scale, without outlay or labor, what we have acquired in Europe on a small scale with extraordinary difficulty, and at an enormous expense. We should look in vain to Panama, or any other of the spots we have previously named, for a course equally advantageous in every respect.

In order that the canal should become the principal element of the advancement of Central America, it must be cut through, not the narrowest part of the tongue of land, but through that country which is the most populous, the most healthy, and the most fertile, and which is crossed by the greatest number of rivers, in order that its activity may be communicated to the remotest parts of the interior. Now, a canal having its course from San Juan to Realejo, would avail itself of the river San Juan, which receives a great many small streams, and particularly three navigable for boats to a considerable distance inland. From the embouchure of the river to the Pacific ocean the canal would run in a straight line about two hundred and seventy-eight miles, enhancing the prosperity on either bank of more than a thousand miles of territory, taking into consideration the sinuosities of the lakes and the course of internal rivers. Let us consider the almost miraculous effects that would be produced by the annual passage through this

the country of two or three thousand ships, exchanging foreign productions with those of Central America, and spreading everywhere activity and wealth. We can picture to ourselves those now solitary banks bordered with towns and villages; those now gloomy and silent lakes teeming with lively fleets; those hitherto uncultivated lands made fertile, their forests and mines explored, and the rivers which flow into the lakes and the San Juan carrying into the heart of the land all the advantages of civilization.

At Panama, on the contrary, such a canal could only cross a country marshy, unwholesome, uninhabited, and uninhabitable, which would offer a passage of but thirty miles, amidst stagnant waters and barren rocks, yielding no spot of ground fitted for the growth of a trading community, for sheltering fleets, or for the development and interchange of the produce of the soil.

Thus, in every point of view, a canal through the lakes would present advantages not to be met with in any other place; but, what is most important to observe is, that Providence seems to have pointed out this particular tract of country, as presenting the least formidable difficulty of execution.

In fact, according to the surveys made by Mr. Garella, by order of the French government, a canal through the isthmus of Panama presents insuperable difficulties. The length of the suggested canal through Panama would be, it is true, only about thirty miles, and the utmost height to be attained only one hundred and seventy-seven feet;* but the great difficulty to be overcome in the completion of canals in general, lies in the supply of water to the superior level. Now, as it appears at Panama this is the great obstacle, the bold engineer proposes to make a monster tunnel, the cost of which would be two millions of pounds sterling, and which would present to the passage of large ships the most serious inconveniences.

We are about to show that through the lakes, a canal, although much longer, would be less costly. We will for this purpose describe the country in view.

CHAPTER II.

Description of the places through which the canal of Nicaragua is to pass—Length of its course.

[See the map No. 3.]

The proposed canal between the Atlantic and the Pacific oceans, commencing at the port of San Juan, and terminating at the port of Realejo, would traverse: 1st, the river San Juan, which, according to Mr. Baily, is, with its windings, ninety English miles, and one hundred and four miles, according to the narrative journal

* "Projet d'un Canal de jonction à travers L'Isthme de Panama, par M. Garella"—pp. 79 to 89. Paris, 1845.

of Mr. G. Lawrence, mate and assistant surveyor of her majesty's surveying vessel *Thunder*, in March, 1840; 2d, the lake of Nicaragua, which is ninety geographical miles long; 3d, the river of Tipitapa, joining the lake of Nicaragua to that of Leon, a course of twenty miles; 4th, the lake of Leon, or Managua, which is thirty-five miles; 5th, the isthmus between the lake of Leon and the port of Realejo, twenty-nine miles.

Recapitulation.

Length of the river San Juan		104	miles.
" "	lake of Nicaragua	90	"
" "	river Tipitapa	20	"
" "	lake Leon	35	"
" "	isthmus between the lake Leon and the Pacific ocean	29	"
Total length of the communication between the two seas.		278	"

But we must hasten to say that, in all this length, there are only eighty-two miles which are to be worked.

Height above the level of the ocean.

According to the surveys made by Mr. Baily, an English engineer, in 1837–'38, the lake of Nicaragua is one hundred and twenty-eight feet three inches above the level of the Pacific ocean, at low water and full moon.

The lake of Leon is twenty-eight feet eight inches above the level of that of Nicaragua.

Finally, the most elevated point of land between the lake Leon and Realejo is fifty-five feet six inches above the level of the lake. Total height of the superior level, two hundred and twelve feet five inches.

The difference of level between high water in the Pacific and low water in the Atlantic being, according to Mr. Garella, nineteen feet and a half, it will be necessary to add this difference, in order to know how much the superior level of the canal will be above that of the Atlantic ocean. This variation of level between the two oceans has been considered, by some persons little conversant with hydraulic works, as an obstacle to the construction of a canal; but this objection has no foundation, the difference being a mere question of locks, and nothing more. In the actual case, the lakes must be considered as two large reservoirs, situated above the level of the two seas, and made, by artificial means, to discharge their waters into them. If, therefore, the level of one of the seas is above that of the other, it is evident that the fall into the highest will be less rapid, and will require a less number of locks than on the opposite side.

Recapitulation.

	Above the Atlantic. ft.	in.	Above the Pacific. ft.	in.
Height of the lake of Nicaragua	147	9	128	3
" " Leon	176	5	156	11
" superior level	231	11	212	5

Let us now give all the information we possess respecting the places through which the canal is to pass, in order to show what are the works necessary to the success of the undertaking.

§ 1.—*The river San Juan.*

"The river San Juan," says Mr. Baily, "flows from the lake of Nicaragua at its southeastern extremity, at the place where formerly stood the fort of St. Charles, now completely destroyed. Here is the only discharge for the waters of both the lakes. The whole length of the river, pursuing all its windings from St. Charles down to the port of San Juan del Norte, is ninety miles, (others say one hundred and four miles;) it forms a magnificent stream, somewhat irregular in its breadth, which varies from one hundred to two hundred yards, studded with small islands, forming, for the most part, a channel on each side of them. The depth of water varies from one and a half to seven, eight and nine fathoms. In the mid-stream the depth is generally from three to five fathoms; but during the rainy season, namely, from May to November, the depth is considerably increased; for, according to observations made at the ruined fort near Grenada, in calm weather, in October, 1838, when the rainy season had just terminated, and again in May, 1839, before the rains had commenced, when the lake was at the lowest, the difference of height between these extremes was found to be six feet six inches. In November, 1839, at which time the rains had ceased, the same observations were made, and the result was that the waters had risen fourteen inches less than in the previous year.

"The banks of the river, particularly the right, are fringed with wood of all sizes and descriptions, with a dense undergrowth, forming, altogether, a forest nearly impenetrable; consequently there are no inhabitants, nor is the land cultivated, although of prodigious fertility. The immediate shores are undulating, being in some parts not more than a few feet, and in others between twenty and thirty feet above the surface of the water.

"Two large rivers, the San Carlos and Sarapiqui, besides many small streams, discharge into the San Juan."

According to Mr. A. G***, there are also very large rivers, which have their source in the mountains bordering the country of the Mosquitos, and which discharge by the left bank into the the San Juan:

"From the gentle declivity of the river San Juan, the current is not strong, being at the rate of a mile or a mile and a half per

hour, except in the times of freshets, when it is accelerated variously, according to circumstances. It is navigated all the year round by boats of eight or ten tons burthen, called *Bongos*, and which are generally manned by ten or twelve men, besides the patron. They can carry about one hundred *ceroons* of indigo, or five hundred hides, or a proportionate quantity of Brazilian timber. The obstacles which now prevent the advantageous navigation of the river San Juan are, first, the rapids; second, the drainage occasioned by its efflux into another river, called the Colorado, seventeen miles above the port of San Juan; and lastly, the labyrinths of small islands, which extend ten or twelve miles from the opening of the river Colorado to the mouth of the river San Juan. It is generally believed that at some former epoch the Spaniards purposely enlarged the opening of this branch, with the intent of exhausting the main river at that part to such an extent as to render the river impracticable to navigation, hoping thereby to protect the town of Grenada from external attacks. In the present advanced stage of the science of civil engineering, this obstacle would be easily surmounted. The rapids are four in number, called *Del Toro*, *Del Castillo Viejo*, *De las Balas*, and *De Machuca*, all comprised within an extent of ten miles; but there is a clear water way from one to the other, having good depth of from three to six fathoms; the longest of these rapids is not more than one mile. The rocks by which they are occasioned are all placed transversely to the current, leaving a narrow channel on each side, and showing their ragged and sharpened edges above the surface of the water during the dry season.

"The breadth of the river from this point is between one hundred and one hundred and twenty yards; the current rushes with violence, and dashes with great force against and between the projecting points. The *Bongos*, however, make the passage without hazard, and we have never heard of the occurrence of an accident.

"The Colorado diverges from the San Juan in 10° 50′ north latitude, and, after running in a southwesterly direction, falls into the sea in 10° 46′, forming a dangerous bar. This river abstracts from the main stream a considerable quantity of water, the opening from the San Juan being twelve hundred feet wide, and having in the deepest part nine feet of water at the lowest state of the river. From measurements of this section, carefully taken at two different periods, in May when at the minimum, and in July when much increased by freshets, it appears from calculation that at the first period the loss of water from the river was 28,178 cubic yards per minute, and at the latter observation as much as 85,840 cubic yards. The main current being thus suddenly weakened, the motion of the water becomes sluggish, and the natural effect is, that deposites of sand and mud are formed, which gradually augment where the movement of the water is feeble; trunks of trees and other floating bodies grounding on these, small islets are formed by successive aggregations, which soon become covered with rank grass, reeds, and other herbaceous plants of rapid growth; a great number of these mounds have been thus raised,

and the progress of formation is continually going on. The usual methods of clearing the beds of rivers could here be applied with facility and good effect, as the accumulations are nothing more than silt and sand, with occasional logs buried underneath. A dam across the Colorado branch, constructed on such of the well known plans as might be judged the most efficient, would be indispensable. Then the re-forced body of water, aided, if necessary, by the resources of art, would, by the momentum of its increased velocity, soon clear a channel to the depth that should be deemed requisite; other parts of the river, where such operations might be wanted, could be improved by nearly similar methods, as the bottom is everywhere composed of mud and sand, except about the rapids, where it is of rock or loose stones."

From the preceding account, as well as from the survey made in 1840 by Mr. George Lawrence, mate and assistant surveyor of her majesty's vessel *Thunder*, and from the information which we received from Captain A. G., who travelled through the country in 1842, we may infer the following particulars:

The river San Juan may be divided into four parts. The first begins at the lake, and extends twenty-seven miles, as far as the first rapid; the second comprises the whole space occupied by the rapids, that is to say, fifteen miles; the third extends from the rapids to the bifurcation created by the Colorado, (forty-three miles;) and the fourth extends from the outspring of the Colorado down to the sea, (nineteen miles.)

The first part, from the lake down to the river Savalos, where the rapid del Toro begins, affords an easy navigation, the current being very moderate, and the river, at its efflux from the lake, being from six to seven feet deep in the dry season; but its depth increases, as it advances, from nine to twenty feet. The breadth of the river is no more than one-fourth of a mile. These first twenty-seven miles require very little labor, for in all this distance only one-third of the bed of the river, that is to say, nine miles, requires to be dredged by steam power.

In the second part, which comprises the rapids, the following works would be required: the banks of the rapid del Toro rising gradually, a lock placed at its termination would give the required depth, as there is a channel from nine to ten feet deep. Its length is one mile, and it runs only four miles per hour. For a distance of four miles there is still water, with a depth of from twelve to twenty-four feet; the banks are low, with a single exception on the northern side, where they rise eight feet above the level of the water. They do not attain a greater elevation until we reach the rapids of Mico and Balas. At Castillo Viejo we meet with other rapids, extending one thousand and ninety yards, and being from twelve to twenty-four feet in depth. Here some dredging would be necessary.

After two miles and a quarter of navigable stream, with thirteen feet of water, we approach the rapids of Mico and de las Balas, being together one mile and one-eighth in length. These two rapids are almost contiguous, and therefore considered as one. The

depth of the channel varies between six and eighteen feet; the banks are six to eight up to twenty feet above the level of the water. At this spot a lock would be necessary. Between this rapid and that of Machuca is an extent of three miles of still water, of considerable depth, where there would be scarcely any labor.

The last rapid is that of Machuca; it occupies more than a mile in length, and is considered the most dangerous of all, though its current is less rapid than that of the two last mentioned. Its velocity does not at any point exceed five miles per hour when the water is low. In the dry season it appears only as an extensive shallow, over which a great number of rocks are dispersed, which are most superficially covered with water. In this place, also, the banks are high enough to allow the raising of the waters by means of a lock.

The third part of the San Juan, into which two large rivers, the San Carlos and Serapiqui, flow, is deeply imbedded, so that four or five locks, and less than ten miles of dredging, would suffice to render that portion of the river navigable.

As to the fourth part of the San Juan, extending from the Colorado to the sea, there are nine miles of good navigation; but the remainder, owing to its being shoaly, would require deepening, and the bulk of the water being augmented by stopping its efflux into the Colorado. Still, if it were found indispensable to make an adjacent canal, its length would be only ten miles.

In recapitulating the works to be made in the river, we find—

	Yards.
For the first part, to be deepened nine miles, or	15,840
For the second part, at the first rapid	1,760
" " at the second rapid	1,090
" " at the third rapid	2,000
" " at the fourth rapid	2,016
For the third part, works	17,600
For the fourth part, works	17,600
Total	57,906

Or thirty-three miles.

The length of the locks to be constructed at each of the four rapids will be from two hundred and sixty-two feet to three hundred and fifty-seven feet.

The investigations of Mr. A. G***, made in 1833, confirm, in every particular, what we have above stated; and we arrive at this conclusion: *Firstly*. That, throughout the whole of its course, within ten miles of its *embouchure*, the river San Juan, in its ordinary state, has a minimum depth of six feet. *Secondly*. That, with trifling exceptions, its banks are high enough to enable us, with the assistance of dykes and locks, to increase the bulk of water to the requisite depth. *Thirdly*. That, at some parts, as well as at the mouth, the bed of the river is calculated to receive the necessary operations of dredging by steam power.

Thus, by enclosing each of the four rapids between two locks, and placing one or two at the mouth of the river, we may have, on

the San Juan, nine or ten locks, which, in an ordinary canal, would be sufficient only for a fall of eighty-eight feet; but, as in this case the natural fall of the river would not be altered, the locks would merely serve to augment its depth, and not to restrain the natural flow of the water.

§2.—*Harbor of San Juan del Norte.*

The port of San Juan de Nicaragua, or del Norte, according to the accounts given by Messrs. Baily, Rouhaud, Dumartray, and several other French officers, is extremely large and safe. By inspecting the plan drawn on the chart No. III., in 1832, by Mr. G. Peacock, of H. M. S. Hyacinth, it will be found that the bar is capable of admitting large ships, and that the roadstead affords a good shelter from the northerly winds, which prevail with great violence in those roads.

§3.—*Lake of Nicaragua or Grenada.*

Mr. Baily furnishes us in his pamphlet the following particulars: "The lake of Grenada is ninety geographical miles long, its greatest breadth is forty, and the mean twenty miles; the depth of water is variable, being in some places close to the shore, and in others, half a mile from it, two fathoms, increasing gradually to eight, ten, twelve, and fifteen fathoms, the bottom usually mud. [Mr. A. G*** sounded in the middle of the lake forty-five fathoms.] This basin is the receptacle of the waters from a tract of country six to ten leagues in breadth on each side of it, thrown in by numerous streams and rivers, none of them navigable except the river Frio, having its source far away in the mountains of Costa-rica, which discharges into the lake a large quantity of water near the spot where the river San Juan flows out of it. The embouchure is two hundred yards wide, and nearly two fathoms deep. There are several islands and groups of islets in different parts of the lake, but none of them embarrass the navigation, nor is this anywhere incommoded by shoals or banks, other than the shallow water in shore; and even this is but very trifling, or rather it is no impediment at all to the craft at present in use, the practice being to keep the shore close aboard, for the purpose of choosing convenient stopping places at the close of day, as they scarcely ever continue their voyage during the night.

"The district extending to the eastern coast is called Chontales. Its soil, although covered with trees, presents in different places excellent pasturage, divided into farms, on which the breeding of cattle is chiefly pursued.

"The largest islands on the lake are Omotepe, Madera, and Zapatera. Taken together, the first two of these islands are twelve miles long. Zapatera is almost triangular, and five miles long. Sanate, Salentinane, and Zapote are smaller and uninhabited; but some of them, and the last in particular, are capable of cultivation.

"Near the town of Grenada, there is the best anchorage for ships of the largest dimensions."

§ 4.—*The river Tipitapa.*

"The lake of Nicaragua," says Mr. Baily, "is connected with that of Leon by means of the river Panaloya, (or Tipitapa,) navigable for the boats employed in that country for twelve miles, as far as the place called Pasquiel, where the inhabitants go to cut and bring away Brazilian timber. The four miles which remain between that place and the lake of Leon are not navigable for any kind of boat, whatever may be its construction, because, beyond Pasquiel, the channel is obstructed by a vein of rocks, which, when the river is swollen, are covered with water, but, in the dry season, the water sinks so low that it can only escape through gradually diminishing fissures in the rocks. At a distance of a mile beyond this first vein of rocks, we find another more solid, which, crossing the river at right angles, forms a cascade of thirteen feet descent.

"The river Tipitapa,* which discharges into the lake of Nicaragua, is the only outlet for the lake Leon. The lands bordering this river are somewhat low, but fertile, having excellent pasturage; as at Chontales, they are divided into grazing and breeding farms. All this country covered with Brazilian timber is scantily inhabited. The only village is that of Tipitapa, situated near the above mentioned waterfall. It contains a small church, and about one hundred cottages. The river is crossed by a wooden bridge."

In order to render this river fit for navigation, it would be necessary to construct three locks, and canalize it throughout; but Mr. A. G*** is of opinion that, for the first twelve miles, it would only be necessary to have a lock to increase the depth of the river. Mr. Lawrance says that the navigable part of the river has a depth of from three to eighteen feet, and that the fall of Pasquiel is thirteen feet high. He estimates the length of the river at twenty miles.

§ 5.—*The lake of Leon, or Managua.*

The lake of Leon is from thirty-two to thirty-five miles long, and sixteen miles at its greatest width. It receives from the circumjacent lands, and principally from the eastern coast, a number of streams, none of which may be considered large. According to Mr. Lawrance, it is not so deep as that of Nicaragua; but, according to Mr. A. G***, it is still deeper.

Its banks are higher and more perpendicular than those of Nicaragua, which would allow of the level being raised, if requisite, by the formation of a dam just above the point where it discharges its waters by the river Tipitapa.

§ 6.—*The isthmus between the lake Leon and Realejo.*

Mr. Michel Chevalier says that the account of the celebrated Dampier, who had been at war in those regions, induced a belief

* "According to Mr. Stephens," says M. Michel Chevalier, "the whole fall of the river Tipitapa, which amounts to twenty-eight feet, is comprised within the first six miles from the lake Leon. Mr. Rouhaud, who has assisted in the topographical discoveries in that country, has told me that the fall of twenty-eight feet was distributed as follows, viz: eighteen feet are precipitated by a cascade at Tipitapa, and the remaining ten feet and a half descend from Tipitapa to Nicaragua."

that, throughout the different routes from the lake Leon to Realejo, and from the lake of Nicaragua to the gulf of Papagayo, or to that of Nicaya, the land consists for the most part of level plains, and that between the lake of Leon and the coast of Realejo, the soil is quite flat. Mr. Stephens, in giving an account of his personal impressions, also says that it is a perfect level. Mr. Rouhand, likewise, has spoken in the same terms of the country included between the northwestern part of the lake of Leon and the port of Realejo, and of the tract of land which extends between the same point and the port of Tamarindo. He thinks nineteen feet, or twenty-two feet, to be the height of the bank above the level of the water. Then comes, says he, a small zone on a very slight, and yet sensible, declivity, by which we gently descend to the Pacific ocean. This unanimity of opinions is rather encouraging.

"Mr. Michel Chevalier then adds, (page 96,) 'I see, however, in the description of Central America and Mexico, published in Boston in 1833,* that the highest land between the lake of Leon and the Pacific ocean descends to be only fifty-one feet above the level of the lake. From the same lake to the river Tosta is but eleven miles; and that river not more than three feet above the level of the lake, at the point where a junction might be effected. If fully established, this statement would be of great importance, for we can avoid any extraordinary cutting, and, *a fortiori*, a tunnel. A cutting of seventy-two feet maximum† is nothing unusual in the operations of the engineers of the *ponts* and *chaussees*.

"By employing improved machinery and implements, which are now at the disposal of the engineer, we can execute deep cuttings at little expense in the absence of rocky grounds. In the canal from Arles to Boyc, for instance, the table land of the Lèque has been cut through to the extent of 2,289 yards, the extreme depth being from forty-three to fifty-four yards. The expense has been less than £160,000, notwithstanding its having been executed on the old system.‡ Now-a days, works of this nature are executed with powerful engines; manual labor is confined to mere digging and loading; and upon the great northern railroad of France, a machine has been successfully and economically employed, even for this last purpose."

We have now arrived at an important feature of our work. Up to the the present time, the general opinion of competent persons who have devoted their attention to the junction of the two seas through the State of Nicaragua is, that the canalization of the rivers San Juan and Tipitapa offers no extraordinary difficulty. The only important point to ascertain was the elevation of the land between the lake of Leon and the Pacific. We have seen that the engineers agree in representing this elevation as not being considerable. Dampier, Stephens, Rouhaud, and Baily contend that the country gradually declines to the ocean. According to other infor-

* "Mexico and Guatemala," vol. II., p. 285.

† Adding nineteen and a half feet for the depth of the canal below the water line, which would then be on a level with the lake.

‡ This cutting, accomplished through a rocky and argillaceous soil, has cost £140,000. The canal is only twenty-three feet wide.

mente, the highest ground is forty-nine and a half feet above the lake of Leon; but Mr. A. G***, who explored the country in 1842, has accurately investigated its formation, and has furnished us with the following particulars.

The western coast of the lake of Leon is twenty-six feet above the lake. From hence, the land rises gradually for a distance of 2,735 yards to an elevation of fifty-five feet six inches; here is, then, the culminating point, whence the ground gently descends to the ocean.

At a distance of eleven miles from the western shore of the lake, on the line which the canal should take to join Realejo, we find the river Tosta, which, at this spot, is thirty-four feet above the lake, and of course its source, issuing at the foot of the volcano Telica, must be much more elevated. This river would supply the canal with abundance of water, being on an average sixty-five feet wide and six feet deep at low water. The rapidity of its current, which appears to be considerable, has not been estimated. Supposing it to be twenty inches per second, we find that the bulk of water supplied is thirteen cubic yards per second, a quantity more than sufficient, since Mr. Garella, in page 107 of his work, has calculated that the waste of water occasioned by the opening of locks and evaporation, would not exceed 258,000 cubic yards per twenty-four hours, corresponding with a loss of three cubic yards per second.

These facts enable us to dispense with more elaborate investigations, whilst they sufficiently prove the practicability of the proposed cutting near Realejo.

We must not omit to quote here the words of Captain Sir Edward Belcher, R. N., who explored this country in 1838.

"At the term day," says he, "we pitched our observatory near the sea margin, at the base of the volcano of Conseguina, or Quisiguina, and having completed the requisite observations, started with the *Starling* and boats to explore the Estero Real, which I had been given to understand was navigable for *sixty miles*, in which case, from what I had seen of its course on my visit to the Viejo, it must nearly communicate with the lake of Managua."

"After considerable labor, we succeeded in carrying the *Starling* thirty miles from its mouth, and could easily have gone further had the wind permitted; but the prevailing strong winds rendered the toil of towing too heavy.

"We ascended a small hill about a mile below our extreme position, from which angles were taken to all the commanding peaks. From that survey, added to what I remarked from the summit of the Viejo, I am satisfied that the stream could have been followed many miles higher; and I have not the slightest doubt that it is fed very near to the lake of Managua. I saw the mountains beyond the lake on its eastern side, and no land higher than the intervening trees occurred. This, therefore, would be the most advantageous line for a canal, which, by *entire lake navigation*, might be connected with the interior of the States of San Salvador, Honduras, Nicaragua, and extended to the Atlantic. Thirty navigable miles

for vessels drawing ten feet we can vouch for, and the natives and residents assert sixty more. But steamers will be absolutely necessary to tow against the prevailing breezes." (*Voyage round the World*, *vol.* 1, *pp.* 236. *London: Colburn*, 1842.)

He adds in the appendix, (*vol.* 2, *p.* 307,) that, "In the port of Realejo there is a river, the Donna Paula, which takes a course towards Leon, and is navigable within three leagues of that city. It has been suggested to carry a railroad from Leon to the lake of Managua. As to any canal into the Pacific, unless behind Momotombo, Telica and Viejo range, into the Estero Real, I see little feasibility in the scheme."

It is, then, quite evident that the information of Sir Edward Belcher, although directed towards a different line, confirms the feasibility and facility of constructing a canal through the isthmus of Realejo.

We have already alluded to the salubrity of the climate through the tract of country we have adopted, as well as to the low rate of wages. We deem it useful to quote on this subject Mr. Baily's own observations.

"In executing so stupendous an undertaking," says he, "salubrity of climate, and the means of feeding abundantly and economically so large a body of workmen as would be collected, are subjects that cannot be passed over without notice. With regard to the first, the writer can aver that, during the four months that he was occupied between the Pacific and the lake of Grenada, with a party of forty individuals, there was not a man prevented by sickness from performing his daily labor, although continually sleeping at night in the open air. On the lake and in the river San Juan, with a large party, the men maintained their health well, although exposed to frequent rains in the latter. But when at the port, (del Norte,) or near to it, sickness got among them, which was mainly attributable to the use or rather abuse of ardent spirits, and other excesses, so frequently indulged in at such places. This change, however, is not assignable solely to indulgence in excesses, because San Juan is exposed to all the dangerous influences of climate and temperature peculiar to the Mosquito shore, and all the coast from Cape Gracias a Dios to Carthagena and beyond it.

"The population of the State of Nicaragua may be said not to extend, south only, much beyond the environs of the town of Nicaragua, so that the line of survey approaching it in no part nearer than four leagues, passed over a comparative wilderness, and consequently all provisions were supplied from that place; these are always to be had in abundance, and should circumstances require it, they could be drawn from other parts of the State to almost any extent. The principal articles of consumption are meat, (beef,) maize, frixoles, rice, plantains, and fruits, which can be furnished at moderate prices; as, for example, meat at 3½, 4 and 4½ reals the arroba of 25 lbs., (the *real* is equal to sixpence of English money;) maize, varying according to seasons, 6, 8 or 10, seldom 12 reals per fanega, which weighs about 250 lbs.; frixoles and rice in similar proportions; plantains, which are universally used, especially by

the laboring classes, are so plentiful that a mule load of them (which is from two to three quintals) can be had throughout the year for 2 or 2½ reals; so that if a large number of workmen were to be collected in this direction, there would be found no difficulty in supplying them with all the ordinary necessaries of life.

"The price paid for labor during the survey was $7 50 per man per month, besides provisions, which, on an average, amounted to half a real a day; but this was higher than what is usually given for general field work, in consideration of the men being taken to a distance from their families for an indefinite time. For work such as that in question, good native artisans would be scarce, but there would be no want of laboring hands, for the certainty and regularity of their pay would attract men, not only from all parts of this, but from the adjoining States of Costa Rica, Honduras, and Salvador also, while a judicious system of equitable regulations would insure their docility and submissiveness. The barbarism that has been attributed to this population in the writings before alluded to, needs no other refutation than saying that the imputation is unfounded; nor is it, nor can it be a supposable fact that the peasantry of the one country should differ very much from that of the other adjoining to it, the same language, habits and customs being common to both."

§ 7.—*The harbor of Realejo, on the Pacific.*

Captain Sir Edward Belcher made, in 1838, the survey of this harbor, which we give on the map, No. 3. The same author gives the following particulars:

"Cardon, at the mouth of the port of Realejo, is situated in 12° 23' north, and about 87° 12' west. It has two entrances, both of which are safe, under proper precaution, in all weather. The depth varies from two to seven fathoms, and good and safe anchorage extends for several miles; the rise and fall of the tide is eleven feet, full and change three hours six minutes. Docks or slips, therefore, may easily be constructed, and timber is readily to be procured of any dimensions; wood, water, and immediate necessaries and luxuries are plentiful and cheap. The village of Realejo is about nine miles from the sea, and its population is about one thousand souls. The principal occupation of the working males is on the water, loading and unloading vessels. It has a custom-house and officers, under a collector, comptroller, and captain of the port."—[*Voyage round the World, vol. 2, p. 307.*]

So, according to what we have already stated, it is quite evident that the canal through the State of Nicaragua would have all the required advantages. It would cross the most fertile, the most healthy and populous parts of Central America, and consequently be the more easily accessible to a high state of prosperity and grandeur. It would open into the finest lakes of the world, communicate with extensive rivers, and, by possessing at its extremities two large seaports, it would spread the advantages of civilization over a considerable tract of country.

CHAPTER III.

Dimensions of the canal.

Before we enter upon the calculation of the probable cost of the canal, we are about to establish the dimensions it should have, by adopting the numbers laid down by Mr. Garella in his work on Panama, although the width of one hundred and forty-seven feet, given to it by him, is rather greater than necessary.

The Caledonian, the largest of all existing canals, is only one hundred and twenty-one feet wide at the water line; but in order to render the towing by steam easier, we adopt the greater width.

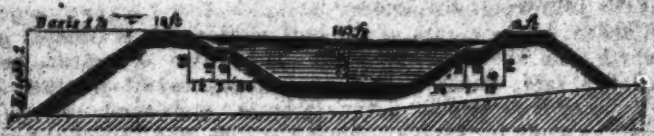
Mr. Garella has calculated the dimensions of the canal in such a manner as to admit merchantmen of 1,200 tons burthen. Now a ship of this magnitude may be compared with a second rate frigate of war, which has the following dimensions:

Dimensions of a ship of 1,200 tons.

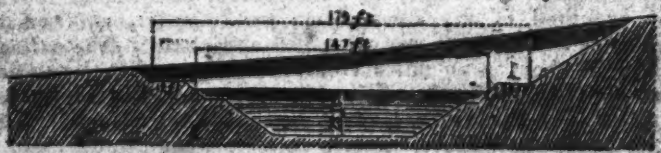
Extreme length at the cut-water	198	feet.
Length of the main deck	175½	"
Width of the main chains	45	"
Maximum draught of water, with cargo	21½	"

Dimensions of the vertical section of the canal.

Made in a side cutting.



Made on an embankment.



Part in a cutting—part in an embankment.

A depth, exceeding by 19 inches the maximum draught of water required by the largest ship..... 23 feet.
Width of the canal at water line, (three widths of the largest ship,)..... 147 "
Width at the bottom..... 65 "
Width at the level of the towing path, 3 feet above the water line..... 155 "

The inclination of the bank is in the proportion of 1½ basis to 1 height, and offers, at the depth of 5 feet, an embankment of 7 feet, to prevent the falling in of the earth.

The towing path, formed on both sides of the canal, would be 18 feet wide.

In the rocky parts the embankments would have a declivity of one-tenth only, and the width would be—

At the water line..... 131 feet.
At the bottom..... 126 "
At the level of the towing path..... 131 "
Inclusive of the paths..... 158 "

Dimensions of the locks.

The locks, to admit ships of 1,200 tons, would have the following dimensions:

Width..... 47 feet.
Length within the gates..... 210 "

These dimensions would be sufficient to admit at the same time into one lock—

Two merchantmen of three hundred tons each, these ships being one hundred and fourteen feet ten inches at their greatest length at the cut-water, and thirty feet wide at the main chains;

Or, two brigs of sixteen guns, the length of such being one hundred and eleven feet six inches, and the width twenty-nine feet four inches;

Or, two lighters of three hundred and eighty tons each, being one hundred and seventeen feet nine inches at their greatest length.

The aforesaid dimensions are one-fifth greater than those of the Caledonian canal, calculated to admit frigates of the third rank.

CHAPTER IV.

Estimate of the expense of constructing the canal.

According to what we have already stated, there are three distinct places where works are to be undertaken:

Firstly. On the river San Juan.

Secondly. On the river Tipitapa.

Thirdly. At the isthmus between the Lake Leon and the Pacific ocean.

We will also follow the estimates laid down by Mr. Garella, for analogous works projected at Panama, but we must remark that the prices mentioned by this engineer are exceedingly high; for instance, he calculates at three francs (about two shillings and sixpence) a day the wages of a laborer; whilst we know that at Grenada and Leon they are as low as sixpence.

According to our former statement, the works required on the San Juan are as follows:

Works on the river San Juan.

At the river San Juan: ten *barrages* locks, at 24,000*l* ..	£240,000
51,040 yards of the bed of the river to be deepened and cleared (reckoning 90 cubic yards per running yard) by steam dredging machine, we find 4,593,600 cubic yards, at 1s. 6d.....	344,520
6,266 yards to be subjected to mining operations, at £16 per running yard.....	100,256
Towing path, at 16s. per running yard, upon an extent of 183,040 yards.....	146,432
Damming the Colorado.....	20,000
Total cost of works on the San Juan.....	£860,808

Works on the river Tipitapa.

Although the river Tipitapa, to be made navigable by mining and dredging, requires these operations only through 7,040 yards, still we think this operation to be necessary throughout its whole course of twenty miles, requiring three locks to compensate the fall, costing as understated, viz:

Three locks.....	£72,000
35,200 yards of the river to be deepened, at 8*l*. per running yard.....	281,600
Towing path, at 16s. per running yard on the extent of 35,200 yards.....	28,160
Total cost of work on Tipitapa.....	£381,760

Works at the isthmus of Realejo.

As regards the isthmus of Realejo, we believe ourselves to be within the truth in allotting upon the whole extent of 51,040 yards from the Lake Leon to the Pacific ocean, a cutting of an average depth of 33 feet, giving for the superficies of the section 484 square yards. We have, then, 484 square yards × 51,040 yards = 24,703,360 cubic yards, which, at 1s. 2d	£1,441,029

The greatest elevation being 212 feet 5 inches above the level of the Pacific ocean, and 55 feet 6 inches above the level of Lake St. Leon, the western declivity will be compensated by 23 locks, and the eastern by 6 locks—in all, 29 locks, costing.....	£856,000
The soil being level pasturage, we calculate the expense of the towing path, at 8*s.* per yard. On the whole extent of 51,040 yards	20,416
Total cost of works on the isthmus of Realejo....	£2,157,445

Works to be executed at the ports forming the extremities of the canal, (given as a memorandum.)

Although the engineers are of opinion that both the port of Realejo and that of San Juan would require but insignificant works, still we calculate the probable expense of deepening the bar at.....	£80,000

General recapitulation.

Works on the river San Juan.....	£860,808
Works on the river Tipitapa.....	381,760
Works on the isthmus of Realejo.....	2,157,445
Works at the extreme ports.....	80,000
Purchase of tools, engines, wagons, &c.....	120,000
Total cost.....	£3,609,013
Casual expenses and reserved fund.....	390,987
Total.....	£4,000,000

We wish the reader to observe that, contrary to the general custom, we have exaggerated the expenses instead of undervaluing them, having supposed a great many extensive works to be requisite, where the reports agree in describing them as perfectly insignificant; besides, we have followed the calculations of Mr. Garella, who, according to his own saying, has adopted in all these works the rate of European wages, with an increase of fifty per cent. [Pamphlet of Mr. Garella, page 120.] On the other hand, if we take into consideration the information of Captain Sir Edward Belcher, (of whom we have already spoken,) respecting the discovery of a river, which he considers to be navigable from the sea up to the Lake Leon, and which could easily be made to admit of large ships, the expenses in this case would be reduced at least one million sterling.

CHAPTER V.

Probable revenue of the canal.

SECTION 1.—The revenue of the canal may be derived, first, from tolls, to which all ships will be subject; secondly, from the increase of value of the lands to be given by the government of Nicaragua to the company.

Let us examine what ships will adopt this new route. These will be not only all those vessels which would otherwise have to double Cape Horn to go to Peru, Chili, Oregon, California, and all other places upon the western coast of America, as well as the islands of Oceania, not only the great number of whalers who go to the South Pacific, but also all those that from Europe are bound to China, Manilla, New Holland, and New Zealand; for, though by the canal the voyage to China will be nearly as long as by the Cape of Good Hope, still the ships will have an advantage in the freedom from maratime dangers, the assistance of the trade winds, and the equatorial currents. On the homeward voyage, the last two advantages would not exist. On the other hand, the plan proposed to Sir Robert Peel by Mr. Edward McGeachy, of Jamaica, (see the Kingston Morning Journal of the 11th March, 1846,) for a communication to be established by steam packets, proves that if the isthmus of Panama or Nicaragua were opened, it would accelerate by these conveyances the correspondence with Canton far more than by the overland mail through Egypt.

By the opening of the canal, the island of Japan would, perhaps, like China, offer an additional stimulus to the commerce of the world.

From the observations we have published in the appendix No. 11, and for which we are indebted to Mr. William Wittich, professor at the London University, it will be seen that the opening of the canal of Nicaragua would shorten the voyage from Europe to the western coast of America 2,846 miles, and save on an average forty-eight days. For by casting up the number of miles and days employed in going and returning between London, Callao, Valparaiso, and Oregon, through the canal, and by comparing the distance with the number of miles and days employed for the same voyage by Cape Horn, the average time will be found as above stated. To go to Canton, Singapore, and Sydney, we find, it is true, (without reckoning the return,) an average increase of 932 miles; but, on account of the winds and currents, we have a diminution in the time of twenty-six days.

With regard to ships from the United States of America, all these distances would be shortened by 1,400 miles and fifteen days, (the ships starting from New Orleans would have a still greater advantage;) consequently, Europe would gain forty-seven days in a voyage to the western coast of America, whilst the United States would gain sixty-two days; to China and Sydney, Europe

would gain twenty-nine days, and the United States forty-four days. (See the map No. 1.)

If, then, a way were cut through Central America, it would first be made use of by all ships at present compelled to double Cape Horn; secondly, by a considerable part of those which now double the Cape of Good Hope.

We will now observe the number of these ships. According to the papers ordered to be published by the minister of commerce of France, the number of ships belonging to the four great maritime powers—France, England, the Netherlands, and the United States—which passed Cape Horn and the Cape of Good Hope during the year 1841, was 2,966, measuring altogether 1,203,762 tons; and it is to be observed that we exclude secondary maritime powers which we may estimate at least at 200,000 tons.

Now, it must be admitted that out of these 1,400,000 tons of shipping, 700,000 tons at least have doubled Cape Horn; for—

	Tons.
In 1835, England and the United States forwarded.....	205,000
In 1835, France.....	30,000
In 1835, Holland, (48,000,) Spain, Denmark, and Sweden	65,000
Total.....	300,000

Which gives a traffic of 600,000 tons.

And certainly, since that time, navigation has been on the increase; for, in 1843, England alone sent round Cape Horn three hundred vessels of the aggregate burden of 110,040 tons; the movement out and home was then 220,080 tons. According to the Newburyport Herald, a paper published in the United States, the number of whalers alone, which in 1844 were employed for the most part in the Pacific ocean, amounted to six hundred and twenty-five, giving an aggregate burthen of 200,000 tons.

In 1843, the tonnage of the mercantile marine of

England with China and the Philippine islands was.....	58,901	tons.
With Austria and Oceania.....	65,890	"
Total.....	124,791	"

Giving by the double voyages 250,000 tons.

It must then be granted that the annual trade by Cape Horn is at present 700,000 tons, and that by the Cape of Good Hope 700,000 tons. It is evident, therefore, that the canal would give passage at least to 900,000 tons, without reckoning the certain increase in the commercial relations which would be the consequence of the communication being rendered easier, and of the vast accession to these countries of European luxuries and industrial produce. By referring to the appendix No. 1, it will be seen how large is the trade between England and Central America, even under existing circumstances.

To ascertain what would be the tollage brought to the company by these ships, we will adopt the calculations of Mr. Garella. According to what we have stated, it may fairly be expected that the

cutting of the isthmus would shorten, on the average, by one month at least, the voyage of those European ships which would adopt this route; and by two months, the voyage of those of the United States. The economy thus resulting to the owners may be estimated as follows for a ship of three hundred tons, viz:

In the maintenance of the crew	£120
In the interest at 1½ per cent. on the value of the cargo, supposed to be worth 4,000*l.*	60
In the interest at 1 per cent. on the value of the ship, supposed to be worth 3,600*l.*	36
Total saving in the month	216
Reduction of insurance on the ship and cargo at 1 per cent.	76
Total saving	292

Equal to a saving of 19s. 7d. per ton.

The ships belonging to the United States having their voyage shortened by two months would gain double; that is to say, thirty-nine shillings per ton. In order, then, to treat them on the same footing as all the other nations, it would be just to make them pay double tollage. So, by admitting only ten shillings per ton for European vessels, and twenty shillings for those of the United States, we could reckon on—

600,000 tons, at 10s.	£300,000
300,000 tons, at 20s.	300,000
Yearly revenue of the canal	600,000

We perceive that this undertaking would bring to the shareholders a very high interest; for, deducting two per cent. for the keeping in repair, and one per cent. for the sinking fund, there would remain for the shareholders 12 per cent. per annum on the capital employed.

In order to develop the resources of the State of Nicaragua, and create commercial and maritime interests therein, we would suggest that every ship bearing the flag of Central America, and having one-half of the crew, including an officer, composed of natives, should pay one-fifth less than ships of any other nation. In this way Central America would soon possess good sailors, and a respectable commercial marine, at the expense of foreign merchants, who, with a view to the advantage offered by a reduction of tolls, would sail under the flag of Nicaragua, forming one-half of their crews of native sailors.

SECTION 2.—We have stated that the secondary profits of the canal would arise from the increase in the value of the soil. According to our information, the government of Nicaragua would cede to the company all the land lying on the right and left banks of the canal throughout its entire course, to an extent of two leagues inland, forming three hundred square leagues, or about 1,200,000 acres. These 1,200,000 acres are, at the present moment,

worth 1s. 6d. per acre. The proposed gift by the government of Nicaragua to the company is, therefore, now of the value of ninety thousand pounds. If we deduct from the above number 200,000 acres as probably incapable of cultivation, and 300,000 more that would be required for the service of the company, producing no income, or as concessions to its engineers, servants, &c., there will remain 700,000 acres to explore and improve. The canal being accomplished, it will easily be granted that these lands may in all probability bear a value of at least 2*l.* per acre. Let us put it at 1*l.* per acre only, and we shall have a property of 700,000*l.* vesting absolutely in the company; for we must not forget that the soil is here very fertile; that they frequently have more than two harvests a year; that the indigo produced in this country is better than that produced in the East Indies; that the tobacco is as good as at Havana; that coffee and sugar are easily produced; that the forests are filled with Vanilla and Brazilian timber; that there are mines to work; and, finally, that the waste water thrown off by the canal locks would afford power for manufacturing purposes. It is then evident that, even if the company should limit itself to the disposal of these lands when the canal is complete, they would derive great profit, were it only by the increase of value; but, in our opinion, there is a greater advantage to be derived from their retention.

We firmly believe that it is important to combine with the construction of the canal the project of colonization, in order that the two undertakings should assist each other, and to enlist as shareholders the mass of emigrants who annually depart for America, and who, according to the statistical information gathered up to this day, set forth with an average sum of twenty pounds per head.*

Thus the shares would be placed in hands most interested in the success of the undertaking; for those only who join an enterprise for the sake of investment, and not mere gamblers, ensure the solidity of an undertaking.

The capital of 40,000,000*l.*, which we presume to be necessary for the construction of the canal, should be divided into 400,000 shares of 10*l.* each. By paying down the value of one or more shares, the emigrant shareholder would be entitled, on his arrival in America, to such accommodations as would enable him to overcome the first difficulties necessarily attendant on early steps in colonization. Every emigrant shareholder would receive from the

* We read in the Journal des Debats, of the 3d May, 1846, that the society formed at New York, the 31st March, 1784, to assist the indigent Germans in the United States, celebrated on Tuesday last the sixty-second anniversary of its foundation. On this occasion they have published a pamphlet, which states, amongst other things, that the number of German emigrants which arrived during last year in the city of New York alone amounted to 30,567, each of them having an average sum of twenty pounds sterling. Of these emigrants, 12,225 arrived from Havre, in seventy-eight ships; 9,617 from Bremen, in seventy-seven ships; 3,718 from Antwerp, in twenty-five ships; 2,525 from Hamburg, in twenty-four ships; 1,989 from Rotterdam, in thirteen ships; and 493 from Ghent, London, and Liverpool, in five ships. The greater part have taken their direction towards the southern States. In 1844, there arrived only 17,000 German emigrants at New York.

company twenty acres of land to cultivate, as well as the necessary implements for that purpose.

The 700,000 acres of land would be thus distributed among 35,000 emigrants, and sold to them on the following terms: Ten years' time would be allowed for the emigrant shareholder to pay to the company the price for the twenty acres allotted to him, as well as the outlay incurred by the company in procuring him dwelling, food, and all the accommodations required. The payment should be made by annual instalments, and proportionate to the progressive increase of value likely to take place every year in the property.

So, the whole of the first year having been entirely taken up by preparing and tilling the ground, the emigrant shareholder should not be made liable for any payment whatever during that time. The annual instalments should begin to be paid at the end of the second year, and accomplished in the progressive manner indicated in the following table:

	Per acre per annum. £. s. d.
At the end of the first year	0 0 0
" " second year	0 1 0
" " third year	0 1 6
" " fourth year	0 2 0
" " fifth year	0 2 6
" " sixth year	0 3 0
" " seventh year	0 3 6
" " eighth year	0 4 0
" " ninth year	0 4 6
" " tenth year	0 5 0
" " eleventh year	0 5 6
	1 12 6

So, every acre of the land will procure to the company in the course of eleven years a net profit of 1l. 12s. 6d.; and, consequently, 700,000 acres of land will bring, in the above stated lapse of time, the corresponding profit of 1,137,500*l.*

The company would establish as many villages as would be necessary for the number of colonists. Each village would be erected on the most healthy spot, and in the vicinity of a river; it would be composed of two hundred dwellings, each dwelling being appropriated to one family. A village would then cost—

Two hundred dwellings, at 4*l.* each	£800
Maintenance for the first six months, and seed, at 4*l.* per family	800
Church, stores, and schools	280
Casual expenses	120
	£2,000

If we divide this sum by the number of families, we shall find that the outlay will be 10*l.* par family in ten years, to be reimbursed

as above stated. Now, let us suppose that in about ten years the company has established 175 villages, containing 35,000 families; the expense will have been 350,000*l.*, which the company will be reimbursed by the annual progressive rate. As each of these families has been enabled to buy and pay for twenty acres of land, at the progressive rate above mentioned, the company will have received for 700,000 acres, the sum of 1,137,500*l.*, from which, deducting 350,000*l.*, the outlay for the construction of villages, there will remain a clear profit of 787,500*l.*, exclusive of the interest received upon outlays. We must also remark that the colonists, being shareholders, will have paid 787,500*l.* to themselves, in their capacity as a company; thus there would be a perfect amalgamation of interests between the shareholders and the colonists, who would be equally interested in the success of the undertaking. Thus, deducting this sum from the amount (4,000,000*l.*) necessary for the construction of the canal, the capital expended would be about 3,200,00*l.* only, bringing a net profit of 600,000*l.*, or 18 per cent. per annum.

At present, when the colonist goes to America, he finds no dwelling, no advance of capital, and often no employment; on our plan, on the contrary, by means of a share, he is sure to find, on arriving in America, a wholesome dwelling, livelihood for six months, fertile lands, and community already settled. Moreover, a part of the money paid for the purchase of his land would come back to him as a shareholder; and in about ten years, his property would not only be freed from all burdens, but he might expect at that period that both his share in the canal and his land would be doubled in value.

Thus our project protects all interests, the capitalist realizes large profits, and the emigrants partake of the benefit, with a moral certainty of future prosperity. This neglected country speedily changes to flourishing towns; its lakes are covered with fleets; and its wealth is increased by the progress of agriculture and commerce.

Central America can emerge from her present languor only by following the example of the United States, viz: by borrowing from Europe labor and capital for this first object. Independent of the advantages of its geographical position, and of the fertility of its soil, the State of Nicaragua presents to European emigrants advantages which are not to be found in the United States. In the north of America, the population settled itself in the beginning on the eastern coast, gradually extending inland. As long as the uncultivated lands were not far from the sea, the European emigrants easily found employment; but now the case is altered, and the great number of foreigners that daily arrive in the United States become, for the following reason, a burden to the nation:

The uncultivated lands where adventurers may easily find employment, are three hundred leagues from the coast; and as, in most instances, the emigrants are destitute of means to reach those remote districts, they become, in the towns on the coast, a prey to indolence and misery.

In Central America, the reverse would be the case; the indigenous population has settled by preference on the coast of the Pacific ocean, deserting all that part situated opposite the ancient world, so that, when the country is in a position to require colonists and European laborers, they may arrive through the canal to places already inhabited; and the population will gradually extend from the west to the east, and not, as in the United States, from the east to the west, getting nearer to Europe, in proportion as it increases, and offering facilities to the new colonists, till they reach the extreme borders of the country.

The prosperity of Central America is connected with the interests of civilization at large; and the best means to promote the welfare of humanity is to knock down the barriers which separate men, races, and nations. This course is pointed out to us by the Christian religion, as well as by the efforts of those great men who have at intervals appeared in the world. The Christian faith teaches us that we are all brothers, and that in the eye of God the slave is equal to the master, as the Asiatic, the African, and the Indian are alike equal to the European. On the other hand, the great men of the earth have, by their wars, commingled the various races of the world, and left behind them some of those imperishable monuments which, in levelling mountains, opening forests, canalizing rivers, has a tendency to upset these obstacles which divide mankind, and to unite men in communities, communities in people, and people in nations. War and commerce have civilized the world. The time for war is gone by; commerce alone pushes its conquests. Let us then open to it a new route; let us approximate the people of Oceania and Australia to Europe; and let us make them partakers of the blessings of Christianity and civilization.

To accomplish this great undertaking, we make an appeal to all religious and intelligent men, for this enterprise is worthy of their zeal and sympathy. We invoke the assistance of all statesmen, because every nation is interested in the establishment of new and easy communications between the eastern and western parts of the globe. Finally, we call upon capitalists, because, whilst they are promoting a glorious undertaking, they are sure to derive a *large profit thereby*.

APPENDIX No. 1.

State of the trade of Central America, according to Mr. Thompson, up to the year 1829, and of that of the town of Gautemala up to the year 1840.

We give here certain statistical information on the State of Gautemala, and a sketch of the importance of its commerce, both in imports and exports, which will be found under the following heads:*

First. A list of the capitals, their districts, and principal produce.

Second. An extract from the report of a special commission, appointed by the government of Gautemala, with a view of showing the commercial situation of all the States of the republic.

Third. A table of the imports, from 1822 to 1829 inclusive, into the different States of America, not only from England, but also from all the other States of Europe.

Fourth. An expose of the state of commerce in the town of Gautemala during the year 1839, deduced from information obtained in 1840 from different merchants of Gautemala-la-nueva, names of the districts in Central America, their principal capitals, produce, &c.

The five States of Central America are divided into forty-eight partidos, or districts, having each of them a capital. Besides these capitals, the number of towns and villages in the whole republic amounts to two hundred and fifty-three.

The following table will give the names of the districts, their capitals, and their produce:

THE STATE OF GAUTEMALA—Thirteen districts.

Districts.	Capitals.	Produce.
Zacatepequs	Guatemala-nueva	Cochineal, cotton, common cloth, fruits.
Chimaltenango	Chimaltenango	Wheat, maize, European fruits.
Solola	Solola	Cattle.
Totonicapan	Totonicapan	Goat hair, with which they manufacture stuffs and garments; wheat, ware, guitars, wooden tools, &c., &c.
Guegustenango	Guegustenango	The same produce as Totonicapan; it has also lead mines.
Guesaltenango	Guesaltenango	Idem.
Suchitepéque	Mazatenango	Cocoa, cotton, cattle, timber, &c.
Escuintla	Escuintla	Indigo, cattle, cotton.
Chiquimula	Chiquimula	Gold and silver mines, cattle, horses, mules, indigo, cotton.
San Augustin	San Augustin	The same as at Chiquimula; cocoa, wheat, &c.
Vera Paz	Cohan	Sugar cane, spices, cotton, linen manufactures, dye woods.
Salama	Salama	Sugar and sarsaparilla.
Peten	Remedios	Timber of all sorts.

* The greater bulk of information which will be found hereafter, is taken from the work published by Mr. Thompson in 1829.

THE STATE OF SAN SALVADOR—Three districts.

Districts.	Capital.	Produce.
San Salvador	San Salvador	Indigo, cochineal, cocoa, balms, saffron, cattle, cotton, cloth, saddlery, bridles of horses, gilt, palm nuts, fruits, sugar, and tobacco.
Zongonate	Zonganate	Cotton, wheat, cloth, indigo, cattle, hats, sugar, matting, artificial flowers made of shells, the exportation of which to Peru and Chili amounts yearly to 10,000*l*.
San Miguel	San Miguel	Indigo, cochineal, cotton, leather, netting, bammocks, sacks made of aloes, gold and silver mines.
San Vincente	San Vincente	The same produce as at San Miguel.

THE STATE OF HONDURAS—Twelve districts.

Districts.	Capitals.	Produce.
Comazagua	Comazagua	Gold, silver, copper, and iron mines.
Tegucigalpa	Tegucigalpa	Same produce.
Choluteca	Choluteca	Same produce.
Macaome	Macaome	Same produce.
Cautaranas	Cautaranas	Same produce.
Juticalpa	Juticalpa	Same produce.
Gracias	Gracias	Wheat, sugar, indigo, tobacco, precious stones.
Los Llanos	Los Llanos	Tobacco, &c., &c.
Santa Barbara	Santa Barbara	Same produce.
Truxillo	Truxillo	Same produce.
Sloro	Sloro	Same produce.
Segobio, or Somoto	Segobio, or Somoto	Naptha, tobacco, cattle, and silver mines.

THE STATE OF NICARAGUA—Eight districts.

Districts.	Capitals.	Products.
Leon	Leon	Indigo, timber, cattle, &c.
Grenada	Grenada	Same as above, and cocoa.
Managua	Managua	Do. do.
Realejo	Realejo	Do. do.
Sutiaba	Sutiaba	Do. do.
Massaya	Massaya	Do. and manufactured hats.
Nicaragua	Nicaragua	Do. cocoa, &c.
Matagalpa	Matagalpa	Wheat and cattle.

THE STATE OF COSTA RICA—Eight districts.

Districts.	Capitals.	Products.
San Jose	San Jose	The State of Costa Rica possesses gold, silver, and copper mines.
Cartago	Cartago	
Ujarras	Ujarras	
Borrica	Borrica	
Iscan	Iscan	
Alajuela	Alajuela	
Eredia	Eredia	
Bogases	Bogases	

The State of Guatemala named a commission, in order to examine the situation of the commerce of the republic. It was directed that the inquest should only have in view to ascertain the commercial movement during the five years which preceded and followed the declaration of its independence in 1823. The report of this commission states that the commerce with Spain consisted only in annual exports of 8,500 tercios* of indigo, representing a value of 2,000,000 dollars, (400,000 pounds sterling,) and in the export of a great quantity of cochineal, on the importance of which the report is silent. In return for these two articles, Spanish goods were imported.

There existed an order by which it was prohibited to import a greater amount of goods than those exported.

During the five years which preceded the declaration of independence, the exports were reduced to half of what they had been. They amounted only to $1,000,000, (200,000*l.*) In 1825 the balance was established again, and the exports of indigo were as high as $2,000,000, (400,000*l.*)

Mr. Thompson having obtained from the government the right of examining this report, extracted from it the following table, which he has published.

In order to give an idea of the commercial movement in general, he has selected the necessary documents out of the years 1824 and 1825; but as the commission had neglected to mention the value of some of those articles, although it had pointed them out, Mr. Thompson, in order to render his work as complete as possible, has filled up this gap with information, the authenticity of which is beyond question, and particularly with regard to that supplied by Don Juan de Mayorga, minister of Mexico.

He has completed the work of the commission by giving a double table. The first contains those articles, the importance of which had been mentioned by the commission. The second contains those merely spoken of, to which Mr. Thompson has annexed a value.

—

TABLE OF THE ARTICLES EXPORTED FROM THE STATE OF GUATEMALA.

[Extract from the report of the commission.]

Articles chosen indiscriminately in the years 1824 *and* 1825, *the value of which has been mentioned:*

Indigo, 1824	£400,000
Hides, 1824	6,000
Balms, 1829	39,000

* Every tercio is = 130 pounds.

[Extract from the above mentioned report.]

Articles the value of which is indicated by Mr. Thompson:

Cochineal, 1829	£500,000
Gold and silver	200,000
Iron	6,000
Lead	2,000
Papalillo	2,000
Sarsaparilla	2,200
Coffee	600
Cotton	100,000
Cocoa	300,000
Tobacco	40,000
Sugar	10,000
Pepper	2,000
Corn	20,000
Drugs and medicinal plants	17,000
Pitch and tar	1,000
Cattle	4,000
	£1,651,800

From this table we may infer that the general commerce of Guatemala had risen in 1829 to a sum of 3,300,000*l.*, which supposes a quantity of goods imported equal to a sum of 1,700,000*l.*

Now, as the consumption of that period is considered to be half of English goods, the English trade would only be 850,000*l.* a year. This calculation is certainly erroneous, because in the colony of Belize, the principal entrepot of English goods for Central America, the capital employed in the trade was as high as 2,000,000*l.*

With a view of giving more exact information, Mr. Thompson sets forth a table of the trade between Jamaica and Guatemala, as well as between Belize and England.

This table shows that merchants of Jamaica supply annually those of Guatemala with goods to the amount of 495,000*l.*, and that they receive in exchange indigo and cochineal, 500,000*l.*, which brings the commerce between Guatemala and Jamaica to	£945,000
Goods are annually forwarded from England to Belize to the value of	1,650,000
For which English commerce receives in return indigo and cochineal	1,500,000
Mahogany	400,000
Other produce	200,000
Total amount of commerce between Guatemala and England	£4,695,000

We must observe that this was published in 1829, and Mr. Thompson remarked that the commerce of Belize had, at that period, considerably increased. Commission houses having established themselves, this new intercourse was certain to become extensive. To speak of this port alone, which contained ships of such construction as enabled them to pass the bar of the river Dulce, it was in constant communication with Izabal, a port on the gulf of Dulce, from whence merchandise is forwarded to Guatemala, and vice versa.

Belize is, then, according to Thompson, the only intermediate point between Europe and Central America; but, if we take into consideration its situation and means of communication with the interior of Guatemala, it will be readily acknowledged that, ere long, Santa Thomas will deprive Belize of its present importance.

Before quitting Central America, Thompson made in 1829 a table of the trade of all the new republics with the rest of the world. He states that, having obtained the best information in his power on his return to England, he can safely say that his calculations were as accurate as the matter would allow. He adds, that the commerce of England with these republics chiefly consists in woollen cloths of every description, cotton stuffs, ironmongery, and sundry other articles; and that France and Spain are in possession of the silk, glass, jewelry, wine and spirit trade. The supplies of these last two articles to Guatemala are of little importance, owing to the difficulty which the carriage by land presents.

The town of Guatemala, according to Mr. Thompson, receives through the port of Zonzonate immense quantities of goods from China, whence the abundance is such that it renders them of little value. They are generally worn by the middle classes.

The Spaniards having lost the monopoly since the declaration of independence, the consumption of European goods at Guatemala had experienced a very considerable diminution in price; but, owing to the trade being declared free, the consumption has considerably increased.

Resuming the calculations he made in 1829, Mr. Thompson calls attention to this fact, that the value of goods exported from Great Britain to the new republics represented an average yearly sum of 10,000,000*l*. He adds, that the actual exports (1829) attained 12,000,000*l*. These calculations are grounded on the following tables; and he says that, according to the official extracts taken at the English custom-house, the exports of England to the new republics were, in 1824—

To the Brazils	£3,425,324
To Spanish America	2,377,100
To the same destination, passing by the West Indies	4,197,576
Total exports of Great Britain to the new republics of America	£10,000,000

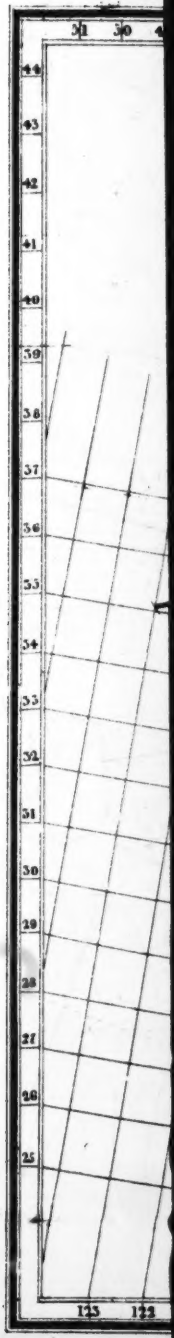
According to the table published by the French ministers, in the month of May, 1829, France had exported to the new republics goods to the amount of	£640,000
The United States had exported	3,330,000
Spain, Germany, and the other parts of Europe	4,480,000
China and the East Indies	1,150,000
	£19,600,000

It is therefore evident that, as early as 1825, the consumption of foreign manufactured produce in the different republics of South America amounted nearly to 20,000,000*l.*, out of which one-sixth, at least, was absorbed by the State of Guatemala. Since that time the consumption has still been increasing; and, were we in want of positive information to show the progress of the trade of the town of Guatemala, Mr. Thompson's statements on the subject would suffice to prove it, particularly as he was secretary of the Mexican commission despatched there in 1823 by the minister Canning, with a view to an inquiry into the trade of these new republics.

He begins by comparing the trade of England with Mexico, Colombia, and Buenos Ayres; first, in the year 1822, during which time the commission was on its way there, and then in 1825, during its stay in the republics. The exports from England were—

	1822.	1825.
To Mexico	£90,000	£1,400,000
To Colombia	27,000	650,000
To Buenos Ayres	230,000	1,600,000
	£347,000	£3,650,000
		347,000
Increase		£3,303,000

Thus it appears that the journey of this commission to Mexico had the effect of raising the trade between England, Mexico, Colombia, and Buenos Ayres, from 350,000*l.* to 3,650,000*l.*; an increase of nearly nine-tenths, and that in three years, with regard to this country only. From 1822 to 1825, then, it succeeded in increasing the exports from England 3,303,000*l.* The services rendered by the company have not been limited to that result only, for the exports of England to all the republics of Central America have amounted from 1823 to 1827 to the enormous sum of thirty-two millions eight hundred and seventy-five thousand eight hundred and fifty-five pounds sterling. In the supposition that the English trade may have realised on the operations a profit of only ten per cent., which is the least to be calculated, the private property of the republics is indebted to the active solicitude of the English government for an increase of 3,287,585*l.*, realised in four years; and that at a moment when the excess of manufactured produce


31
30
44
43
42
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28
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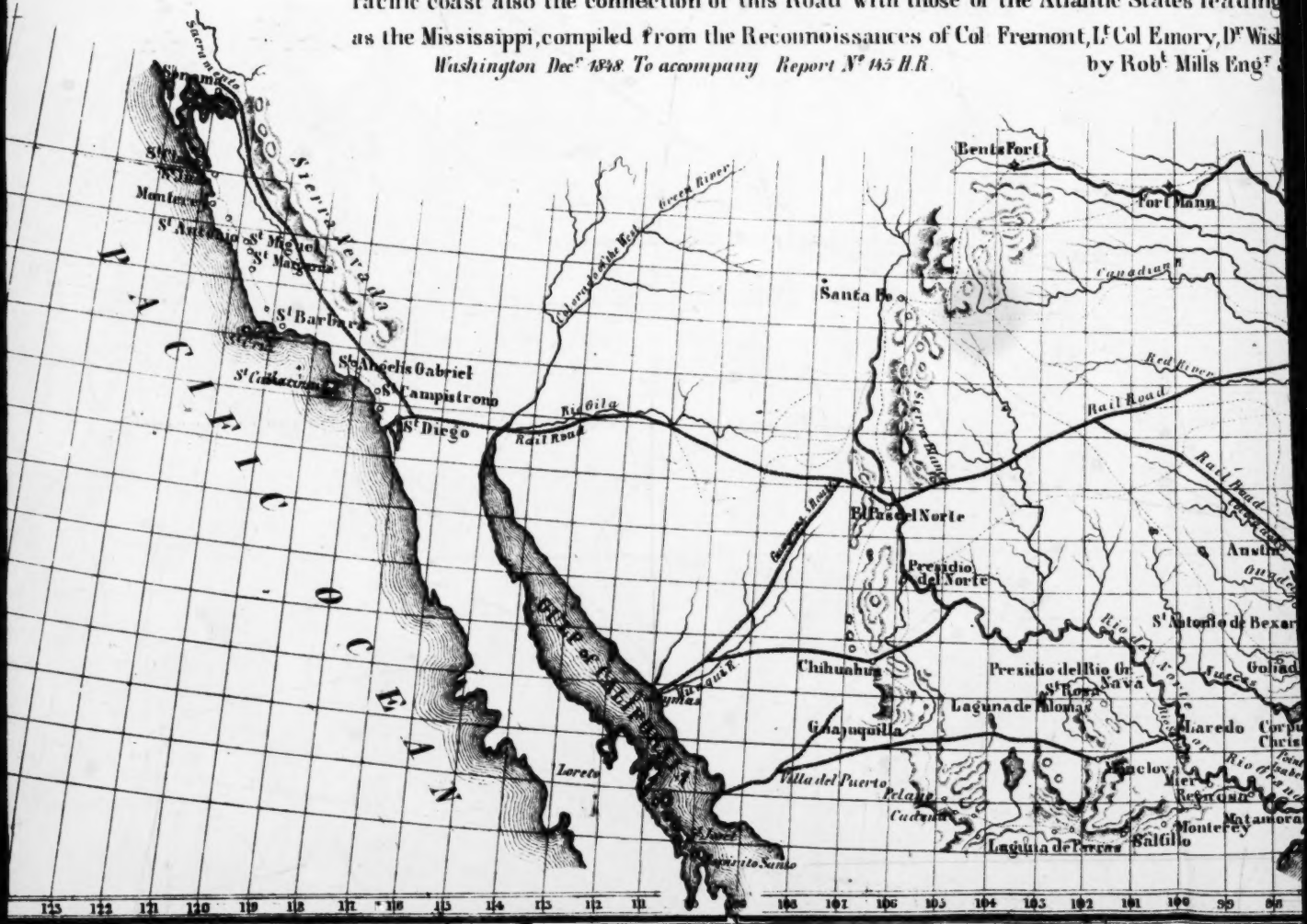
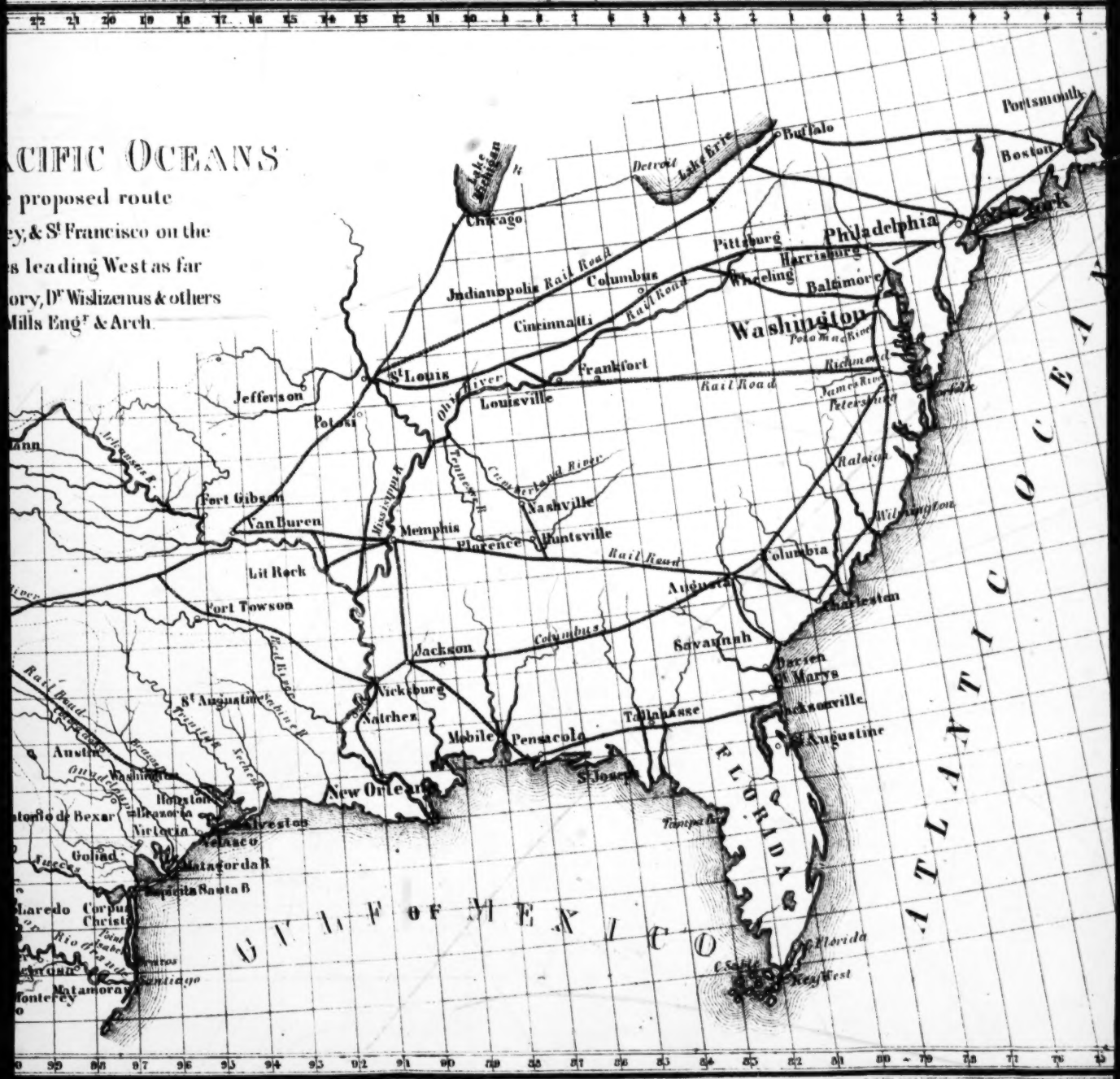
26
25
125
122

MAP
OF THE
COUNTRY BETWEEN THE ATLANTIC & PACIFIC

Included within the latidudes 25 & 42 & the longitudes 75 & 125 West, shewing the propose
of a Rail Road from the Mississippi Valley to the ports of S^{t} Diego, Monterey, & S^{t} Fra
Pacific coast also the connection of this Road with those of the Atlantic States leading
as the Mississippi, compiled from the Reconnoissances of Col Fremont, L^{t} Col Emory, D^{r} Wis

Washington Dec^{r} 1848. To accompany Report N^{o} 145 H.R. by Rob^{t} Mills Eng^{r}



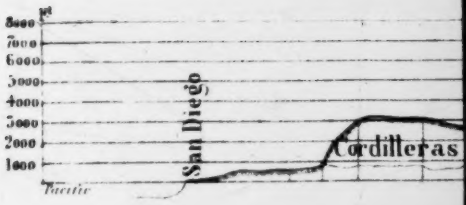

ACIFIC OCEANS
proposed route
ey, & St Francisco on the
s leading West as far
ory, Dr Wislizenus & others
Mills Engr & Arch
Chicago
Detroit
Lake Erie
Buffalo
Portsmouth
Boston
York
Philadelphia
Pittsburg
Harrisburg
Wheeling
Baltimore
Washington
Potomac River
Richmond
James River
Petersburg
Raleigh
Wilmington
Columbia
Charleston
Augusta
Savannah
Darien
St Marys
Jacksonville
St Augustine
Tallahassee
Pensacola
Mobile
St Joseph
Tampa Bay
Florida
Key West
Indianapolis Rail Road
Columbus
Cincinnati
Rail Road
Frankfort
Louisville
St Louis
Ohio River
Jefferson
Potosi
Fort Gibson
Van Buren
Lit Rock
Port Towson
Memphis
Nashville
Cumberland River
Florence
Huntsville
Rail Road
Jackson
Columbus
Vicksburg
Natchez
New Orleans
Galveston
Velasco
Matagorda B
Corpus Christi
Laredo
Matamoras
Monterey
Austin
Washington
Houston
Nacogdoches
Rail Road
Rail Road
Rail Road
St Augustine
Tallahassee R
Trinity R
Brazos
Santiago
Rio Grande
Arkansas R
Mississippi R
Tennessee R
GULF OF MEXICO
ATLANTIC OCEAN
FLORIDA

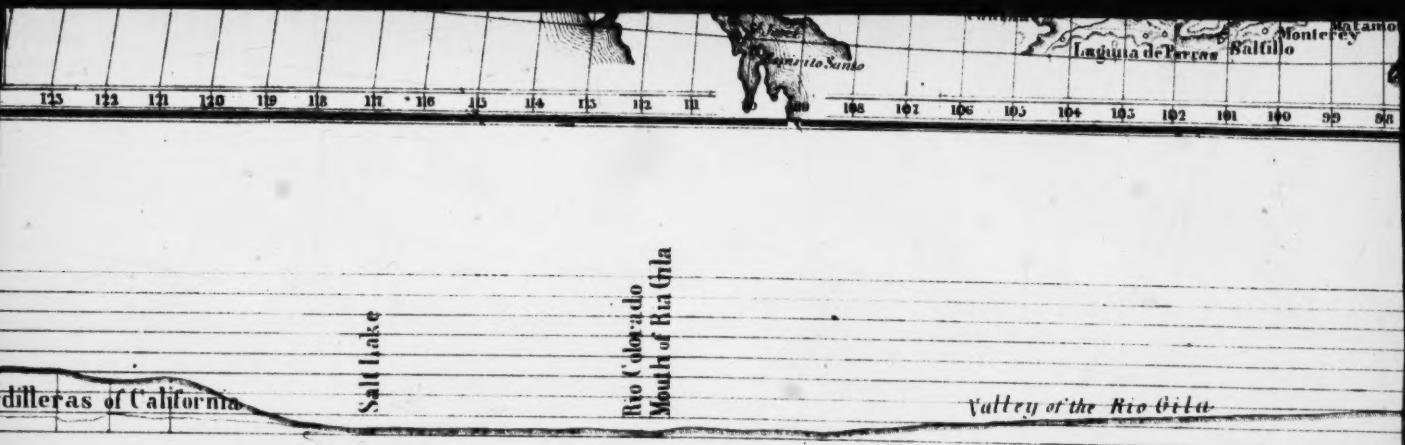
This Map shews the position of our Continent as compared with Europe and Afri
of Europe 3000 miles from us, with a population of 250,000,000, and Asia on the
than 700,000,000. The Rail Road across our Continent will make us the cent

Constructed by Whit

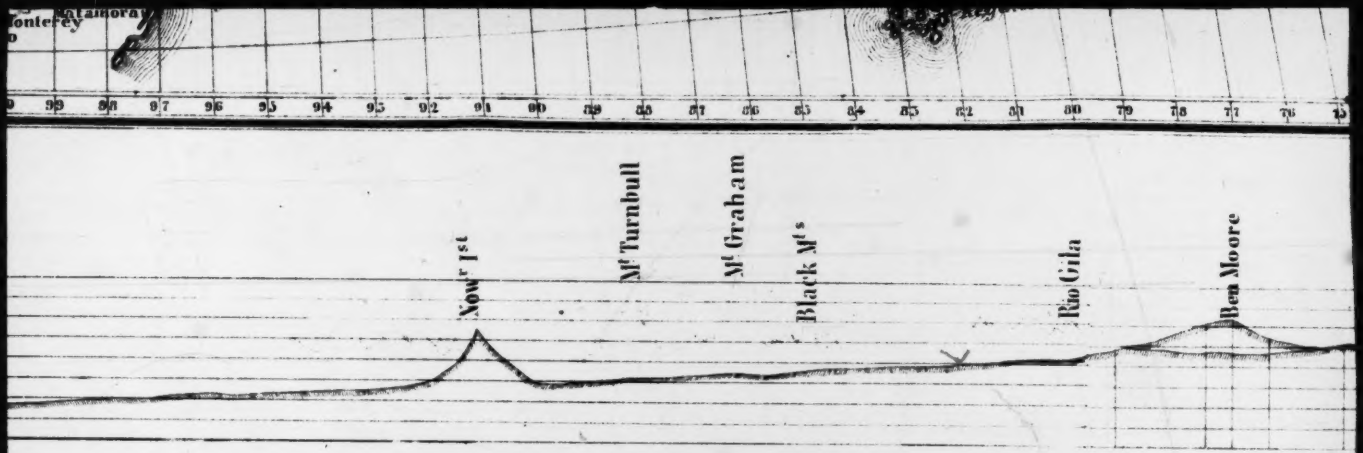
ope and Africa on one side and Asia on the other, placing us in the centre
Asia on the other side, about 5000 miles from us, with a population of more
us the centre and thoroughfare for both.

ed by Whitney

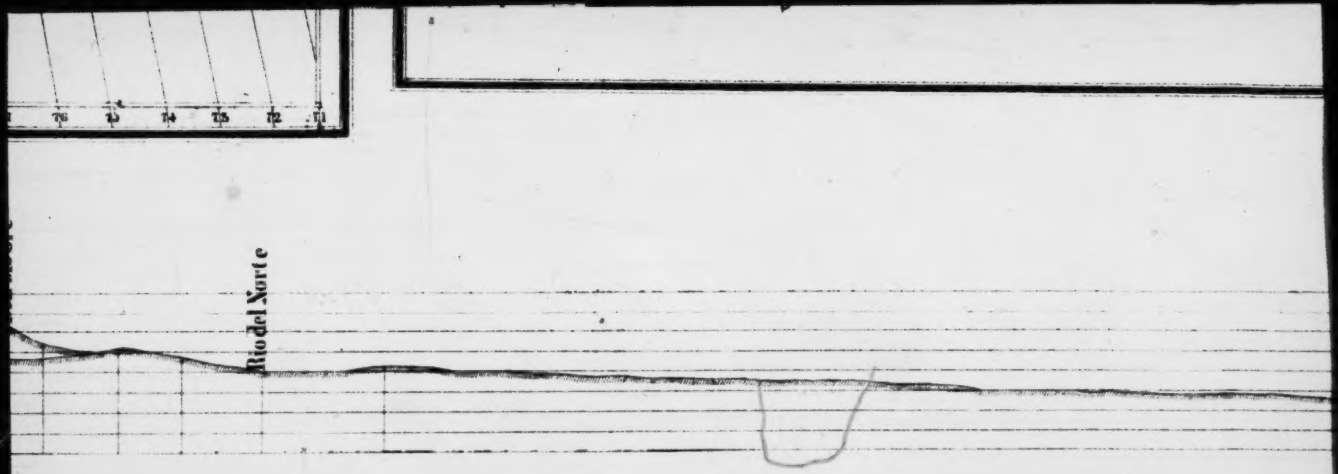

Pt
8000
7000
6000
5000
4000
3000
2000
1000
San Diego
Cordilleras
Pacific


Laguna de Parras
Saltillo
Monterey
Matamo
123 122 121 120 119 118 117 116 115 114 113 112 111 110 108 107 106 105 104 103 102 101 100 99 98
dilleras of California
Salt Lake
Rio Colorado
Mouth of Rio Gila
Valley of the Rio Gila

Barometric Profile of the route ac



ute across the Praries between the Arkansas & Red Rivers from the Valley



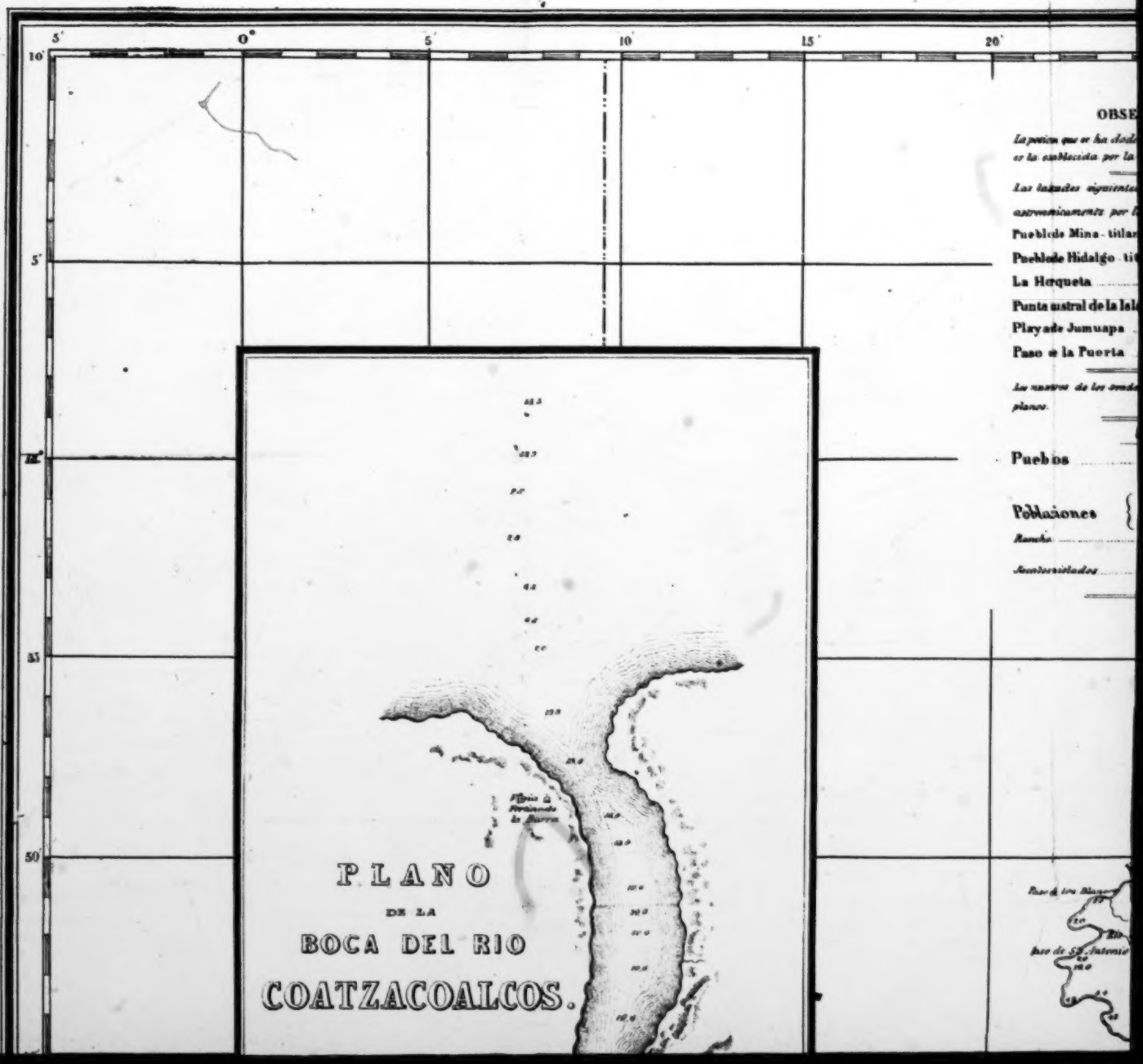
Valley of the Mississippi Memphis & St Louis by the Rio del Norte to San Dieg

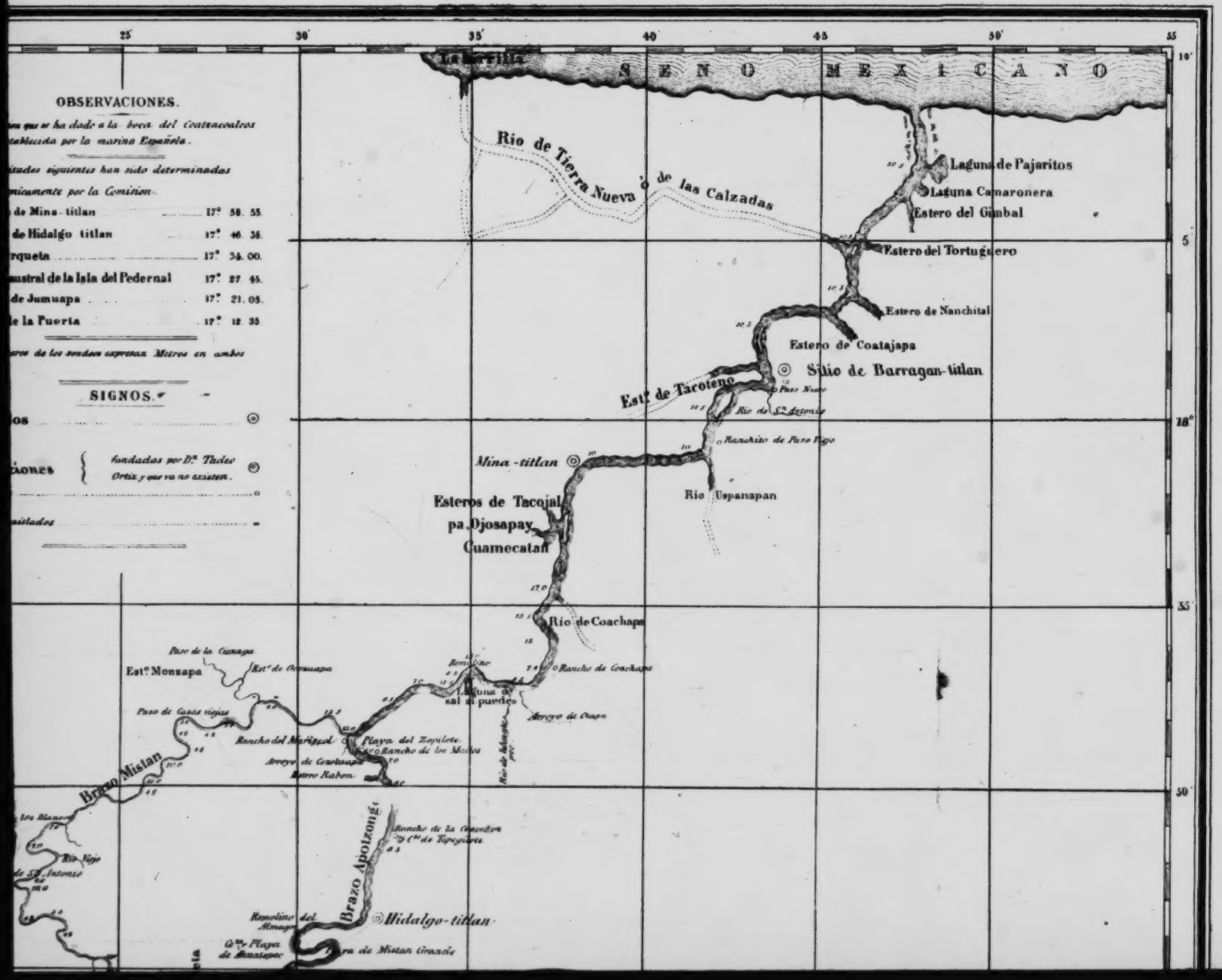
Fort Gibson

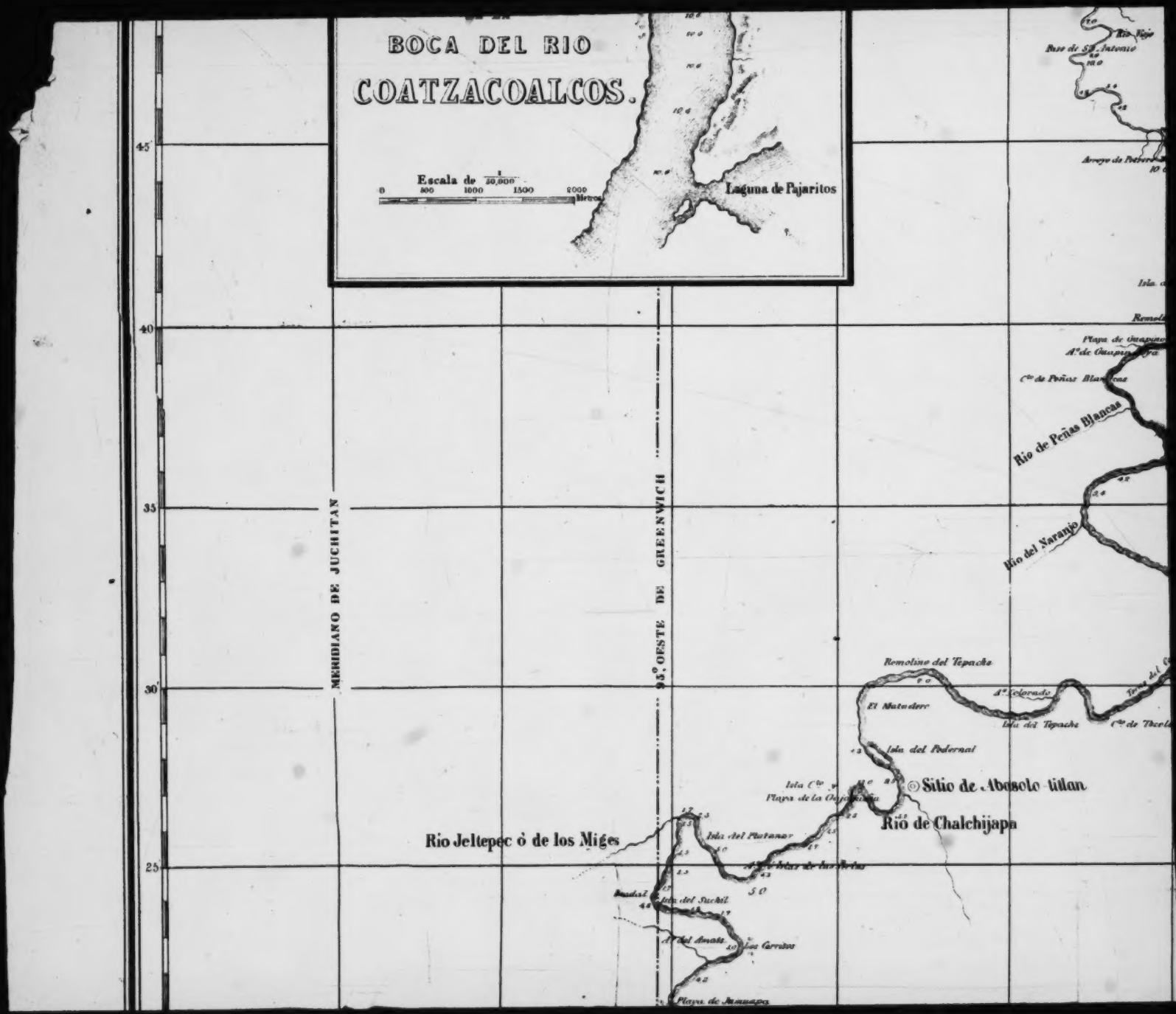
St Louis

Little Rock

n Diego on the Pacific


5'
0°
5'
10'
15'
20'
10'
5'
35'
50'
OBSE
Pueblo de Mina - titular
Pueblo de Hidalgo ti
La Horqueta
Punta austral de la Isla
Playa de Jumuapa
Paso de la Puerta
Pueblos
Poblaciones
Rancho
Fuente de Fernando la Barra
PLANO
DE LA
BOCA DEL RIO
COATZACOALCOS.


OBSERVACIONES.
SIGNOS.
SENO MEXICANO
Rio de Tierra Nueva ó de las Calzadas
Laguna de Pajaritos
Laguna Camaronera
Estero del Gimbal
Estero del Tortuguero
Estero de Nanchital
Estero de Coatajapa
Silio de Barragan-titlan
Estr de Tacoteno
Mina-titlan
Esteros de Tacojal
pa Djosapay
Cuamecatan
Rio Usapanapan
Rio de Coachapa
Estr Monsapa
Brazo Mistan
Brazo Apotzingo
Midalgo-titlan


BOCA DEL RIO
COATZACOALCOS.
Escala de 1/50,000
0 500 1000 1500 2000 Metros
Laguna de Pajaritos
45
40
35
30
25
MERIDIANO DE JUCHITAN
95° OESTE DE GREENWICH
Rio de Peñas Blancas
Rio del Naranjo
Remolino del Tepache
El Matadero
Isla del Federal
Sitio de Abasolo Itlan
Rio de Chalchijapa
Rio Jeltepec ò de los Miges
Isla del Platanar
Isla del Suchil
Playa de Jaraapa

REPÚBLICA MEXICANA

PLANO

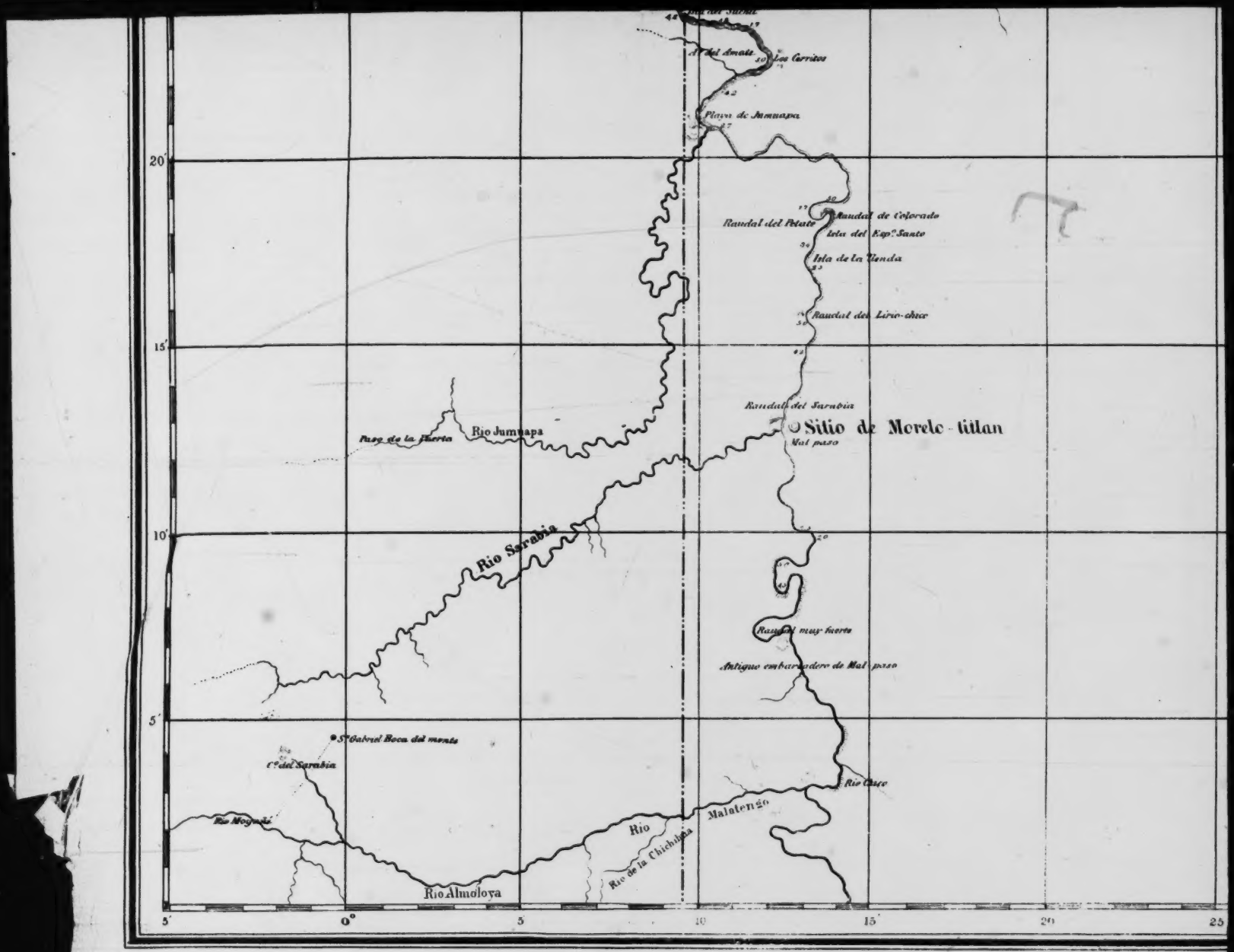
DEL

CURSO DEL RIO

COATZACOALCOS

DESDE LA CONFLUENCIA DEL MALATENGO

HASTA SU BOCA EN EL SENO MEXICANO


Los Carritos
Plan de Jumapa
Raudal de Colorado
Raudal del Petate
Isla del Esp.to Santo
Isla de la Vanda
Raudal del Lirio-chico
Raudal del Sarabia
Sitio de Morelos-titlan
Mal paso
Paso de la Puerta
Rio Jumapa
Rio Sarabia
Raudal muy fuerte
Antiguo embarcadero de Mal paso
S.t Gabriel Boca del monte
C.a del Sarabia
Rio Moyuta
Rio Almolonga
Rio de la Chichihua
Rio Malatengo
Rio Cisco
20'
15'
10'
5'
5'
0°
5'
10
15'
20
25

DESDE LA CONFLUENCIA DEL MALATINCO

HASTA SU BOCA EN EL SENO MEXICANO

Levantado por disposicion de D.n JOSÉ de GARAY, empresario de la obra de la comunicacion OCEÁNICA por el ISTMO de TEHUANTEPEC,

Por la comision cientifica nombrada al efecto.

AÑO

1843.

C. Moro

ESCALAS DE 250,000

Leguas Mexicanas

Leguas Geograficas

Quilometros

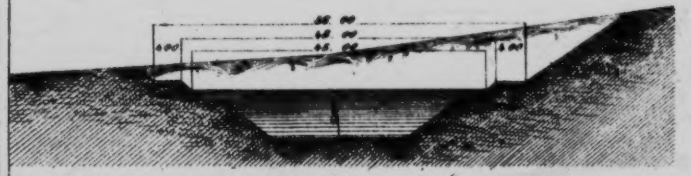
20 15 10 5

25 30 35 40 45 50 55

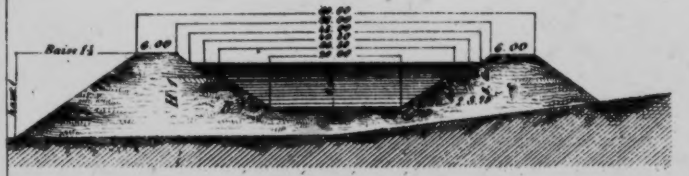
PROFILS EN TRAVERS

du Canal dans les Terres

en Déblai



en Remblai.



partie en Déblai, partie en Remblai

du Souterrain

et

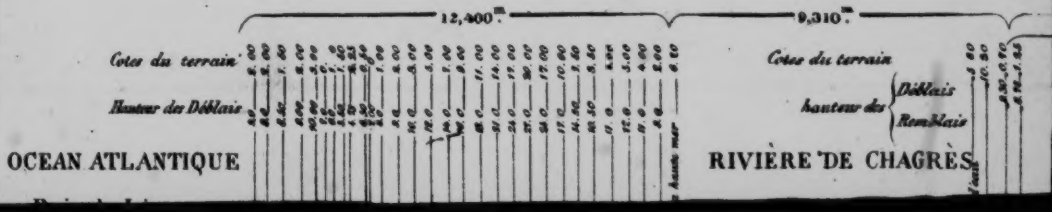
des Tranchées aux Abo

Echelle des Profils en tr
1 pour 1000.

Profil longitudinal

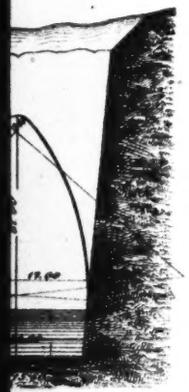
entre la Baie du Limon et le Rio Chagrès

(les cotes de nivellement sont rapportées aux basses eaux de l'Atlantique)



terrain

aux Abords.



rofils en travers
1000.

mètres

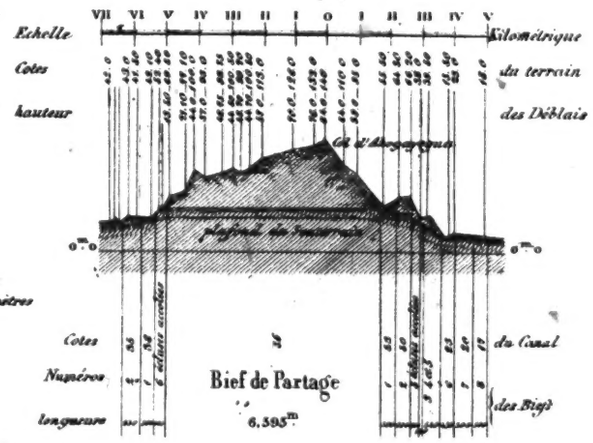
PROFILS EN LONG ET EN TRAVERS
du
CANAL
proposé pour la Jonction des deux Océans
à travers
L'ISTHME DE PANAMA.

Echelles des Profils en long

pour les longueurs, 0.m 005 pour 1000 mètres

pour les hauteurs 0.m 0,120 pour 100 mètres

Variante
du
Point de partage



LONGUEURS DE LA LIGNE DE NAVIGATION
proposée entre les deux Océans.

de la Baie de Vaca de Monte (Océan Pacifique)	
au point de Partage des Eaux (Col d'Obagaregua)	16 100.m
de ce point a la rencontre de la Rivière de Chagres	
(aux dos Hermanas)	38 650
Navigation de la Rivière de Chagres, rectifiée	
entre les dos Hermanas et le Rio Gatun	9 350
de ce dernier Point a la Baie du Limon.	
(Océan Atlantique)	12, 400
Longueur totale	76, 400.m

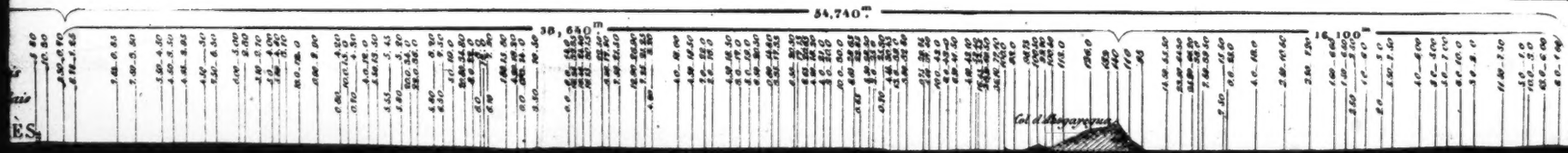
Hauteur du Niveau moyen de l'Océan Pacifique
au dessus du Niveau moyen de l'Océan Atlantique 2.m 908

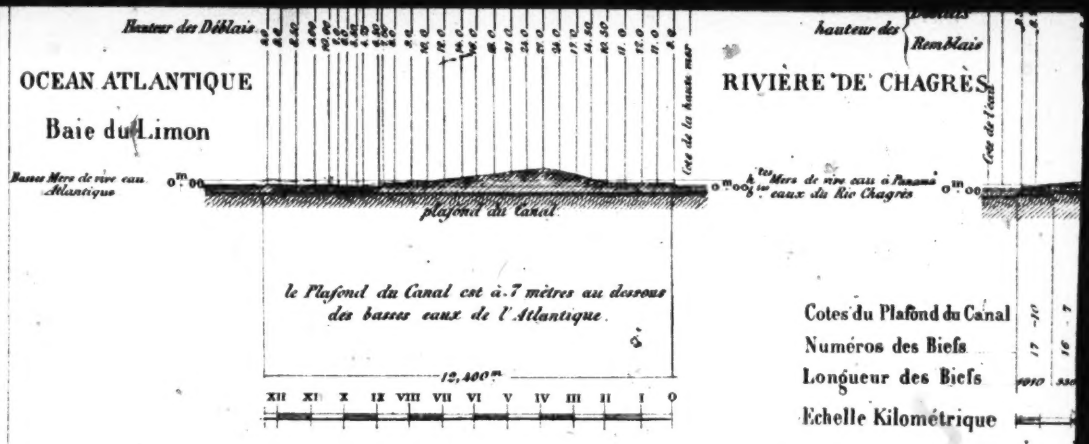
le Niveau de l'Eau dans le Bief de Partage
est à 48 mèt. au dessus des hautes Mers de vive Eau
de l'Océan Pacifique.

le Nombre des Ecluses sur le versant Sud est de
17, de 3 mèt. de Chute chacune, la dernière servant
d'Ecluse de Garde est établie au niveau des plus
hautes eaux de l'Océan Pacifique. elles rachètent
ensemble une différence de niveau de 48.m 00

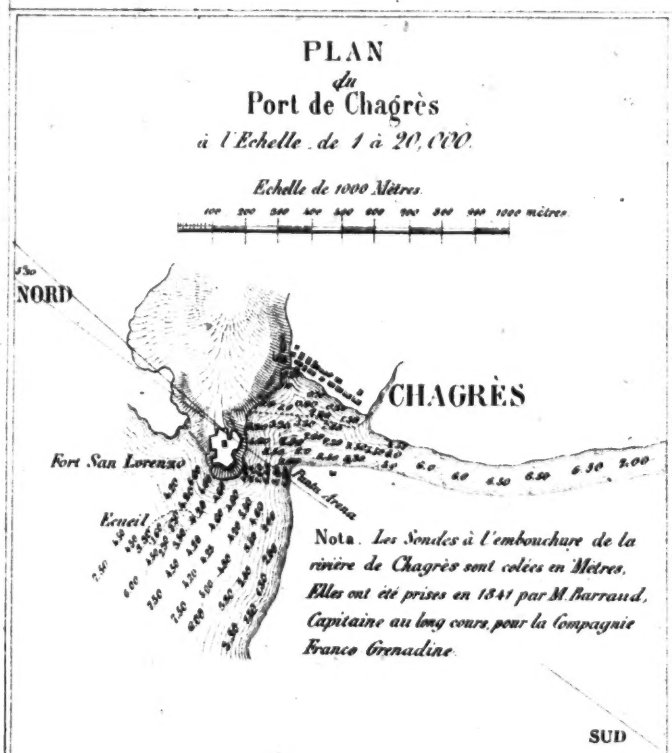
sur le versant Nord, le nombre des Ecluses est de
18 rachetant une différence de niveau de 54, 02

Profil longitudinal
entre le Rio Chagres et l'Océan Pacifique
(les cotes de nivellement sont rapportées aux hautes eaux du Pacifique)



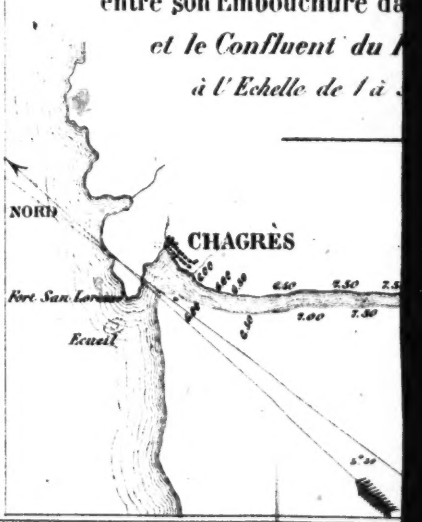

Hauteur des Déblais
OCEAN ATLANTIQUE
Baie du Limon
Basse Mers de vive eau Atlantique
plafond du Canal
le Plafond du Canal est à 7 mètres au dessous des basses eaux de l'Atlantique.
12,400m
XII XI X IX VIII VII VI V IV III II I 0
hauteur des Remblais
RIVIÈRE DE CHAGRÈS
Mers de vive eaux à Panamá
eaux du Rio Chagres
Cotes du Plafond du Canal
Numéros des Biefs
Longueur des Biefs
Echelle Kilométrique

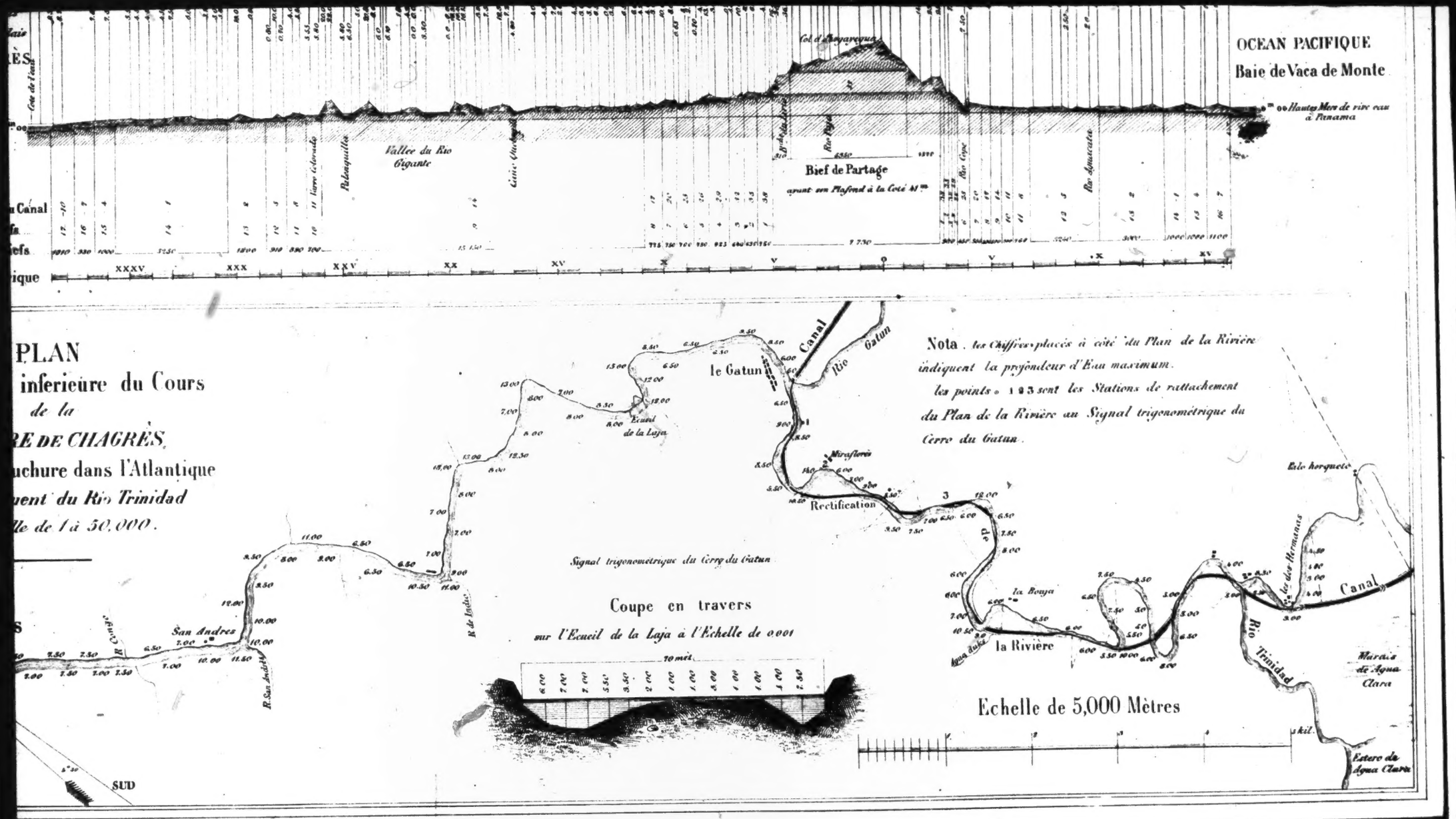
PLAN
du
Port de Chagrès
à l'Echelle de 1 à 20,000



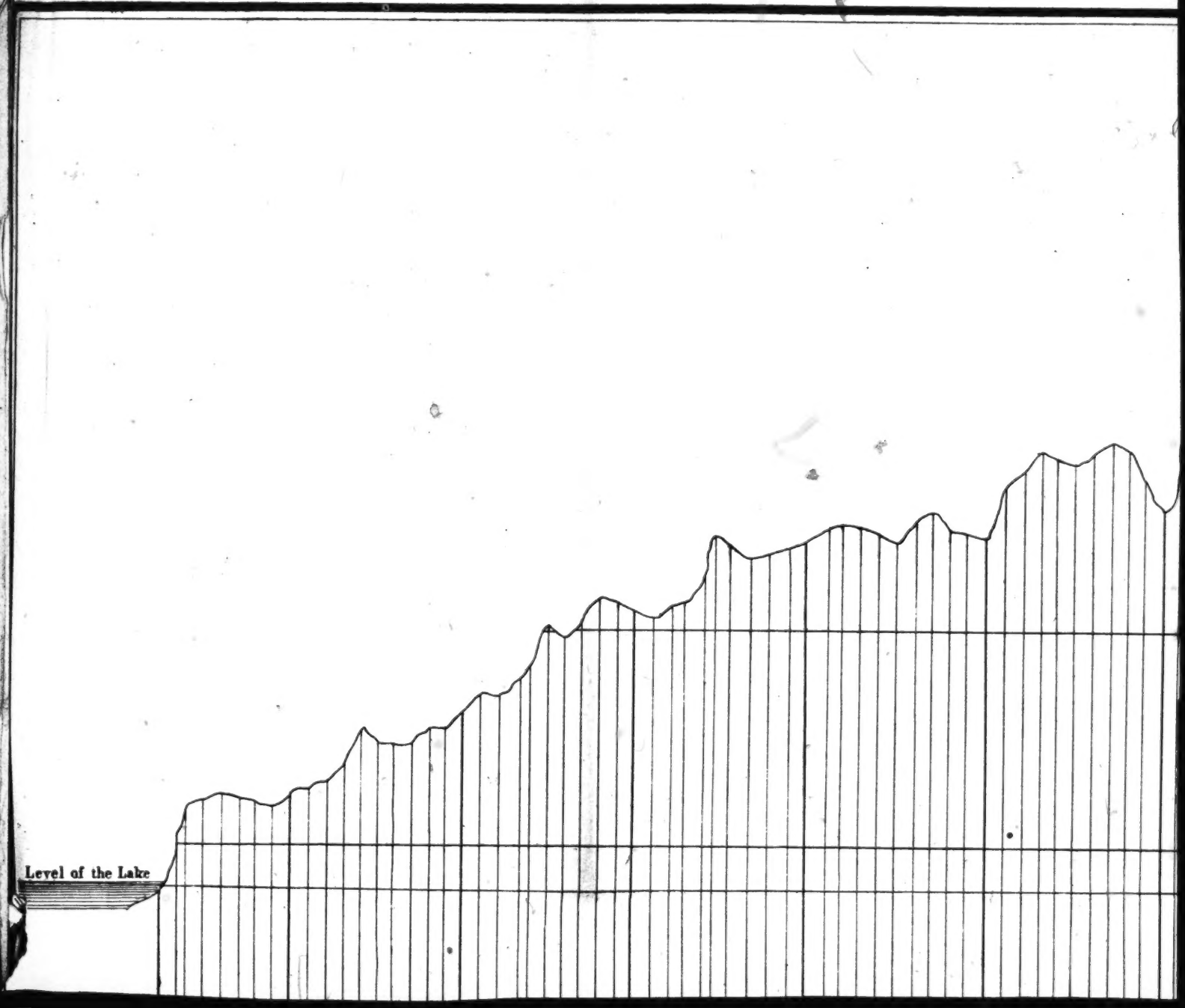
Nota. Les Sondes à l'embouchure de la rivière de Chagrès sont celées en Mètres. Elles ont été prises en 1841 par M. Barraud, Capitaine au long cours pour la Compagnie France Grenadine.

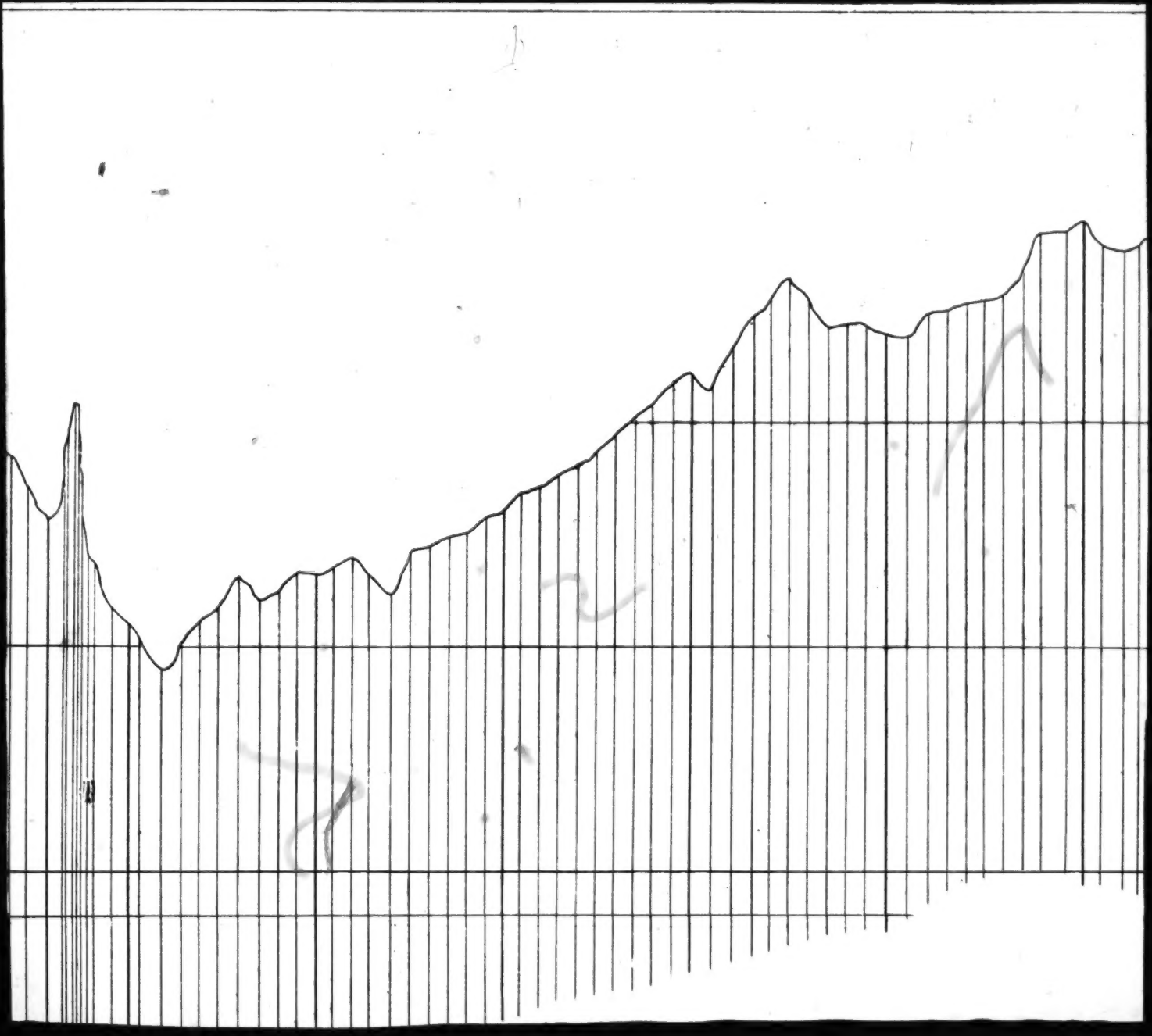
PLAN
de la Partie inferieu
de la
RIVIÈRE DE CH
entre son Embouchure da
et le Confluent du
à l'Echelle de 1 à

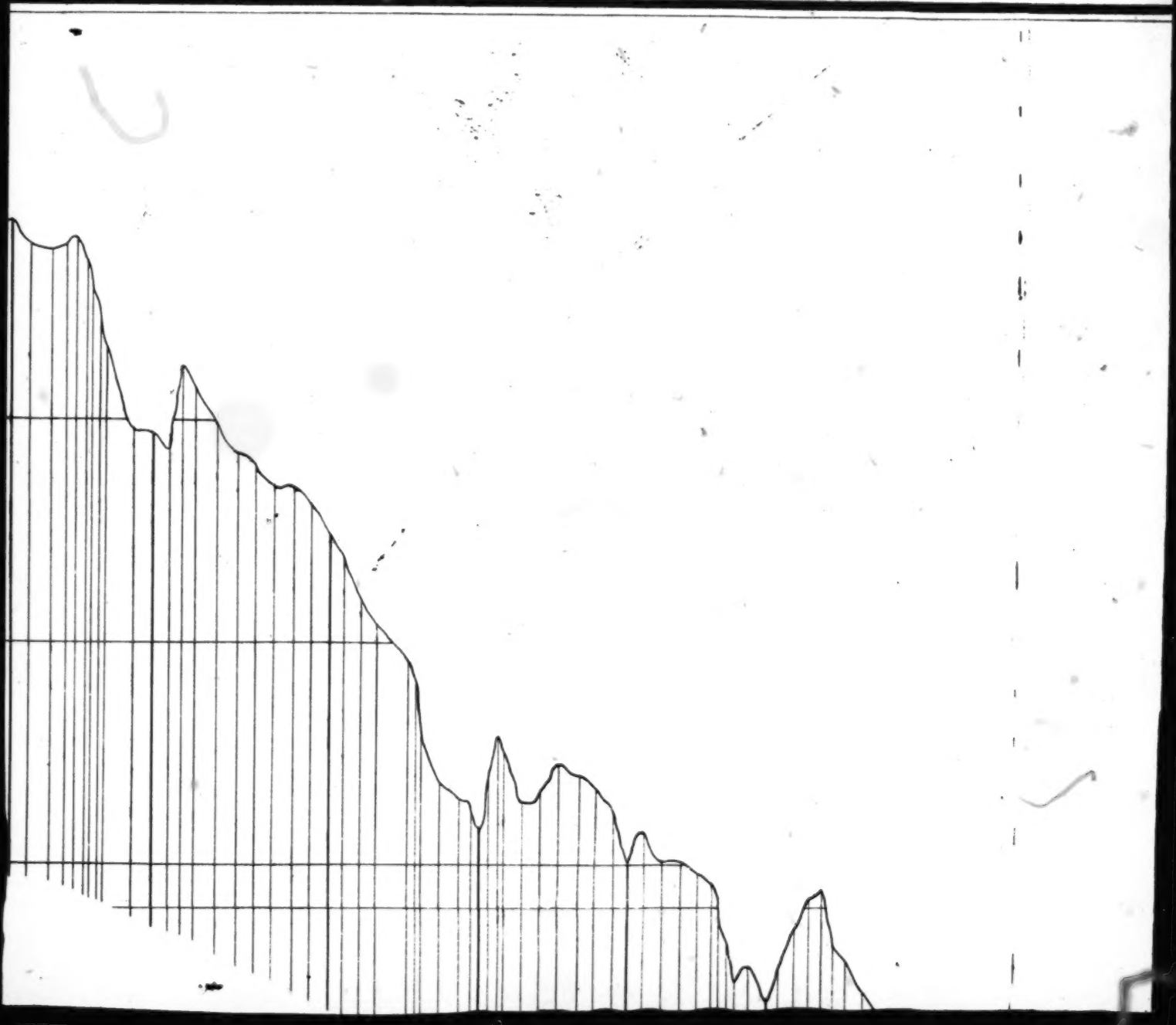



OCEAN PACIFIQUE
Baie de Vaca de Monte
Col d'Aguacate
Vallée du Rio Gigante
Bief de Partage
Rio Cano
Rio Aguacate
Canal
Rio Gatun
le Gatun
Ecueil de la Laja
Miraflores
Rectification
la Bouja
la Rivière
Signal trigonométrique du Cerro du Gatun
Coupe en travers
sur l'Ecueil de la Laja à l'Echelle de 0,001
Nota. les Chiffres placés à côté du Plan de la Rivière indiquent la profondeur d'Eau maximum.
les points 1 2 3 sont les Stations de rattachement du Plan de la Rivière au Signal trigonométrique du Cerro du Gatun.
Echelle de 5,000 Mètres
Rio Trinidad
Canal
Marais de Agua Clara
Estero de Agua Clara
San Andres
SUD

PLAN
inférieure du Cours
de la
RE DE CHAGRES,
uchure dans l'Atlantique
ent du Rio Trinidad
lle de 1 à 50,000.


Level of the Lake





PROFIL

OF THAT SECTION OF COUNT

BETWEEN

LAKE NICAR

AND THE

SOUTH S

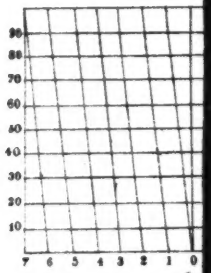
From the Table of Levels given in Thom
referred to the plane of t
SEA

Bureau of U. S. Topographical
Wash. Hood. Del.

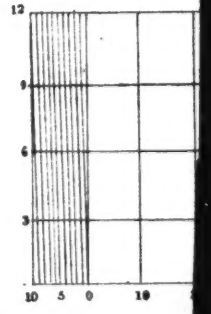
1838.

TILE

COUNTRY SITUATED
EN
ARAGUA
HE
I SEA.

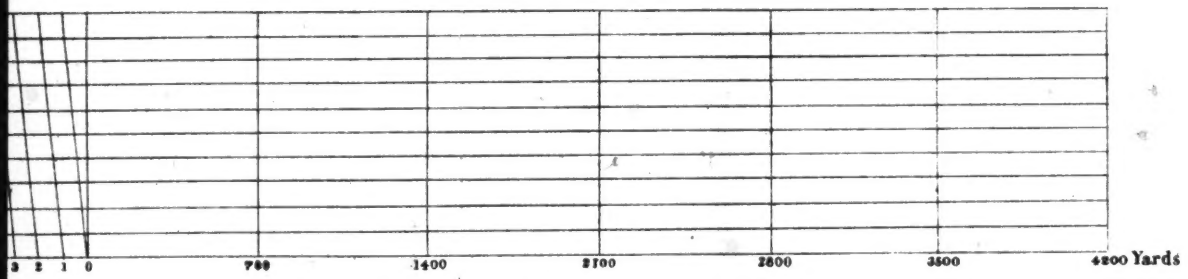


in Thompsons Guatamala
lane of the

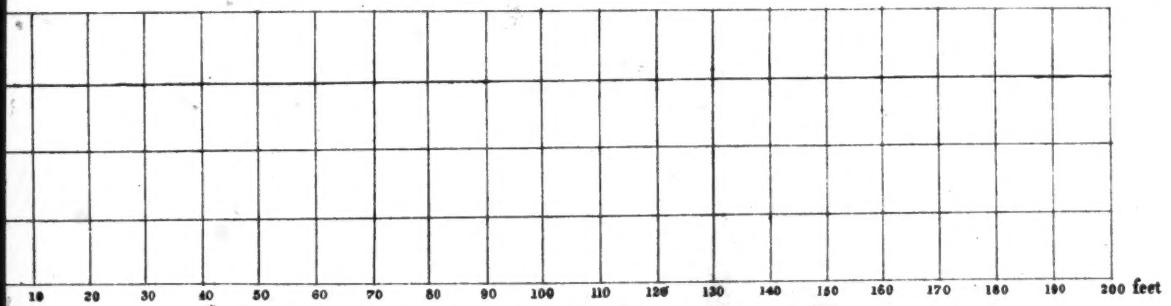


phical Engineers.
. Del.

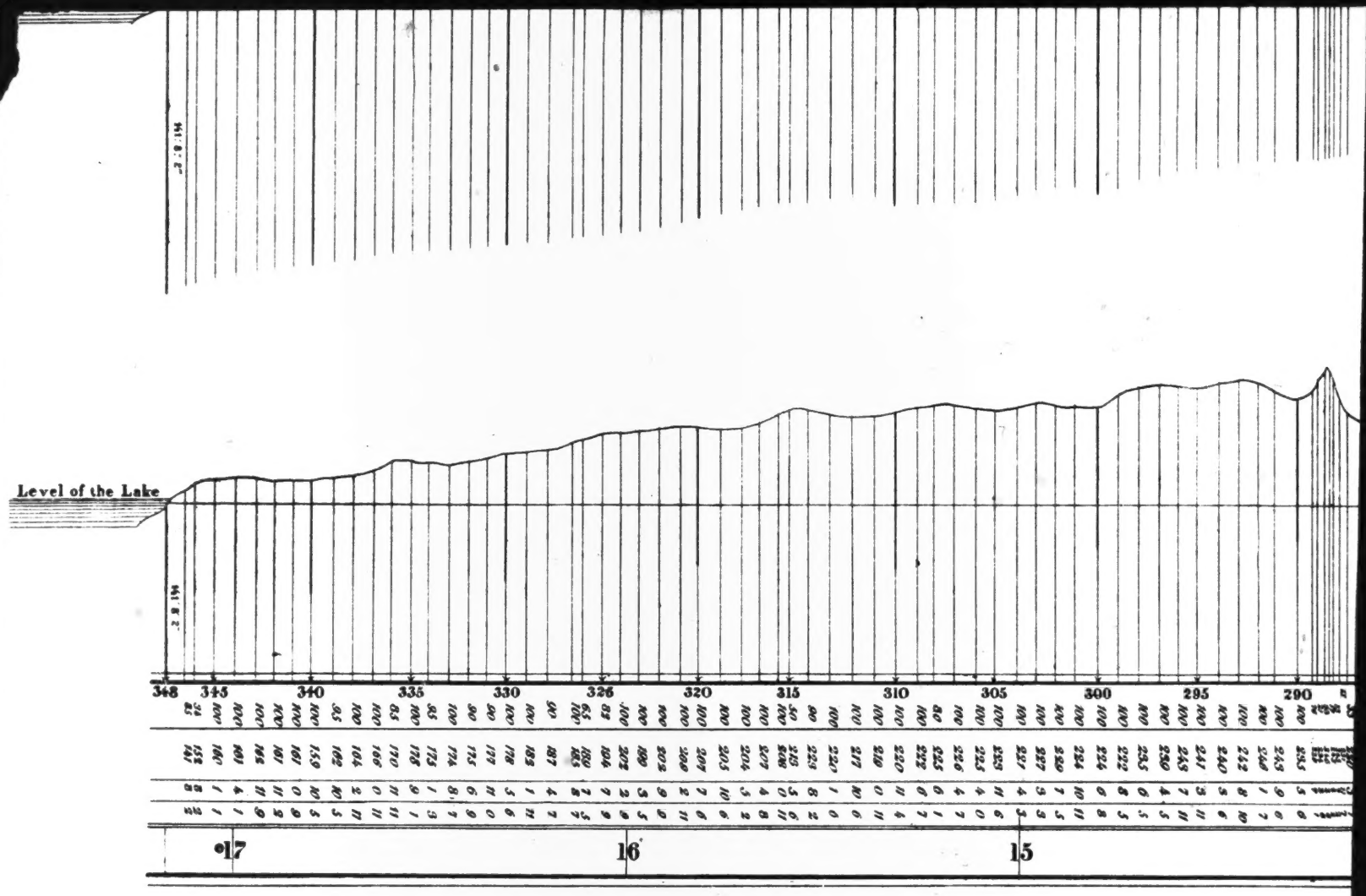
8.

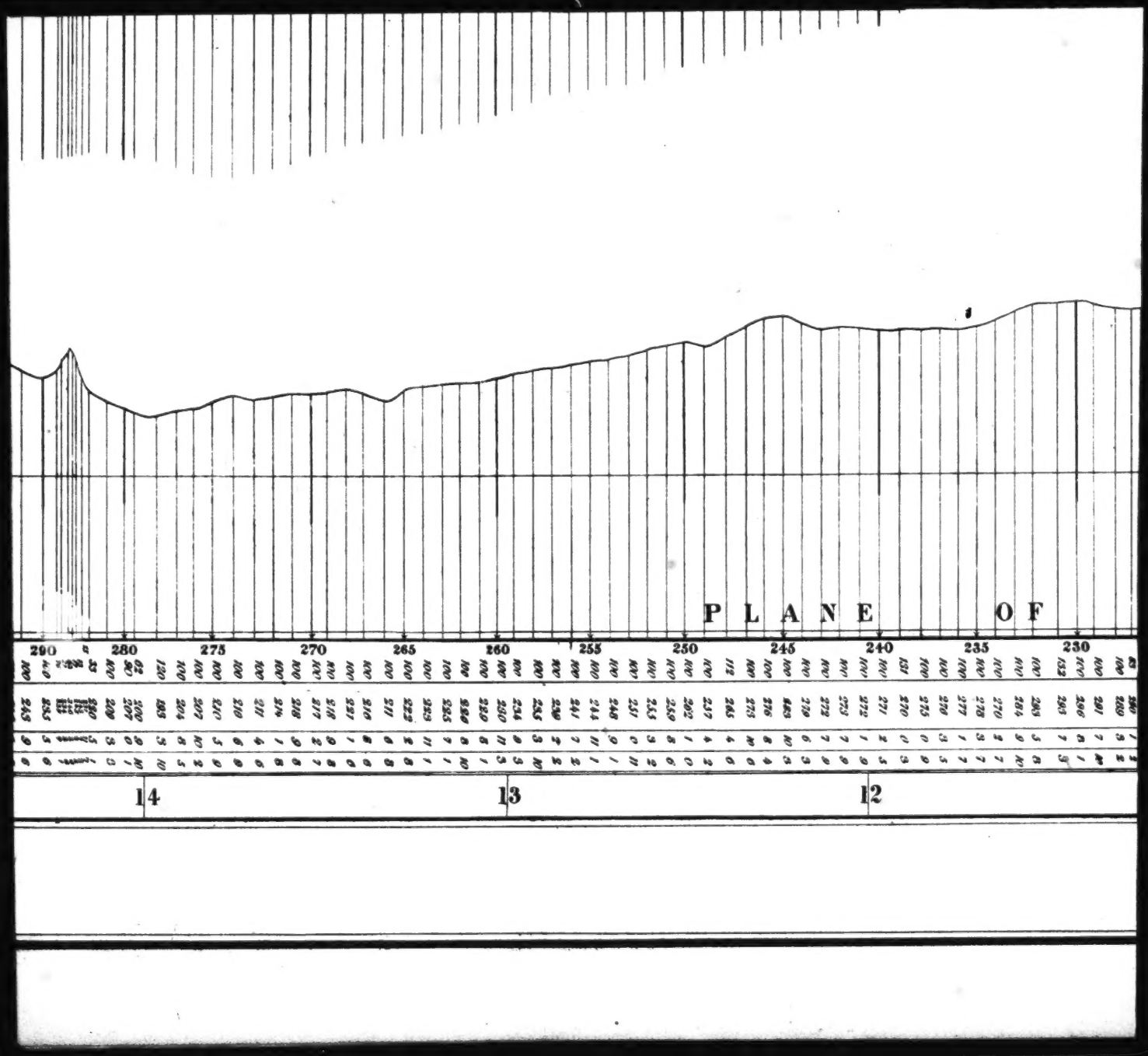


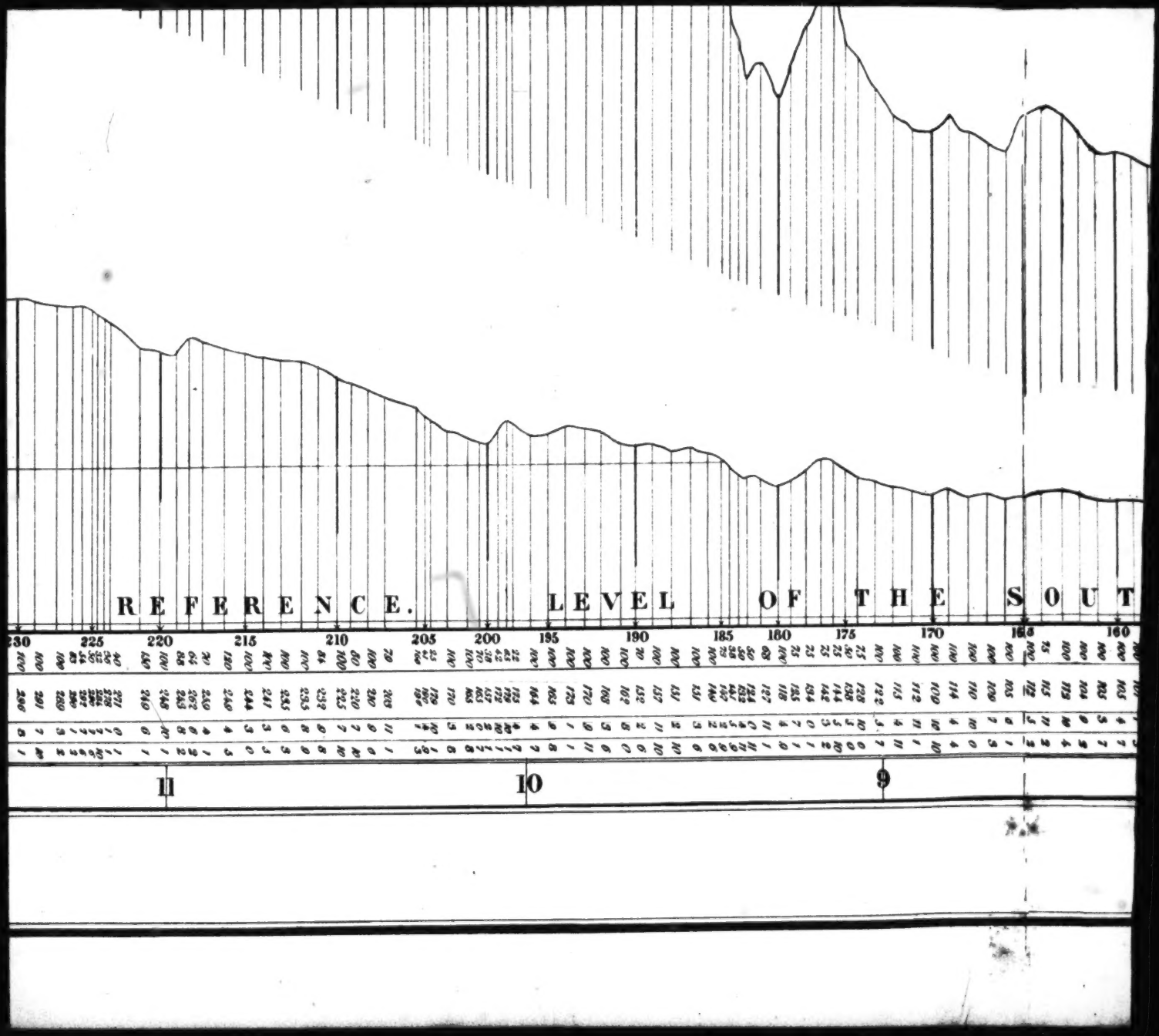
Horizontal Scale 700. Yards to 1 inch

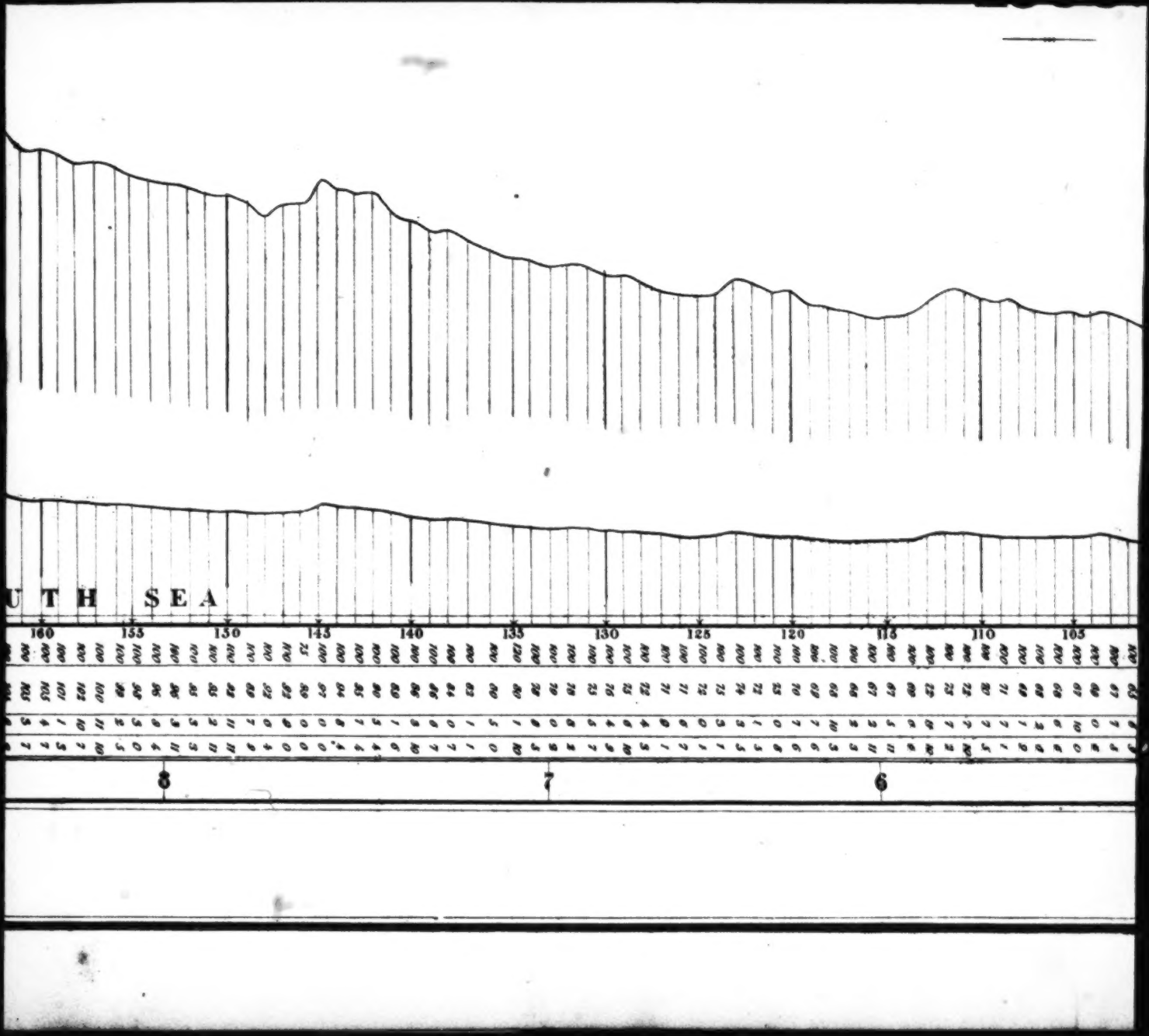


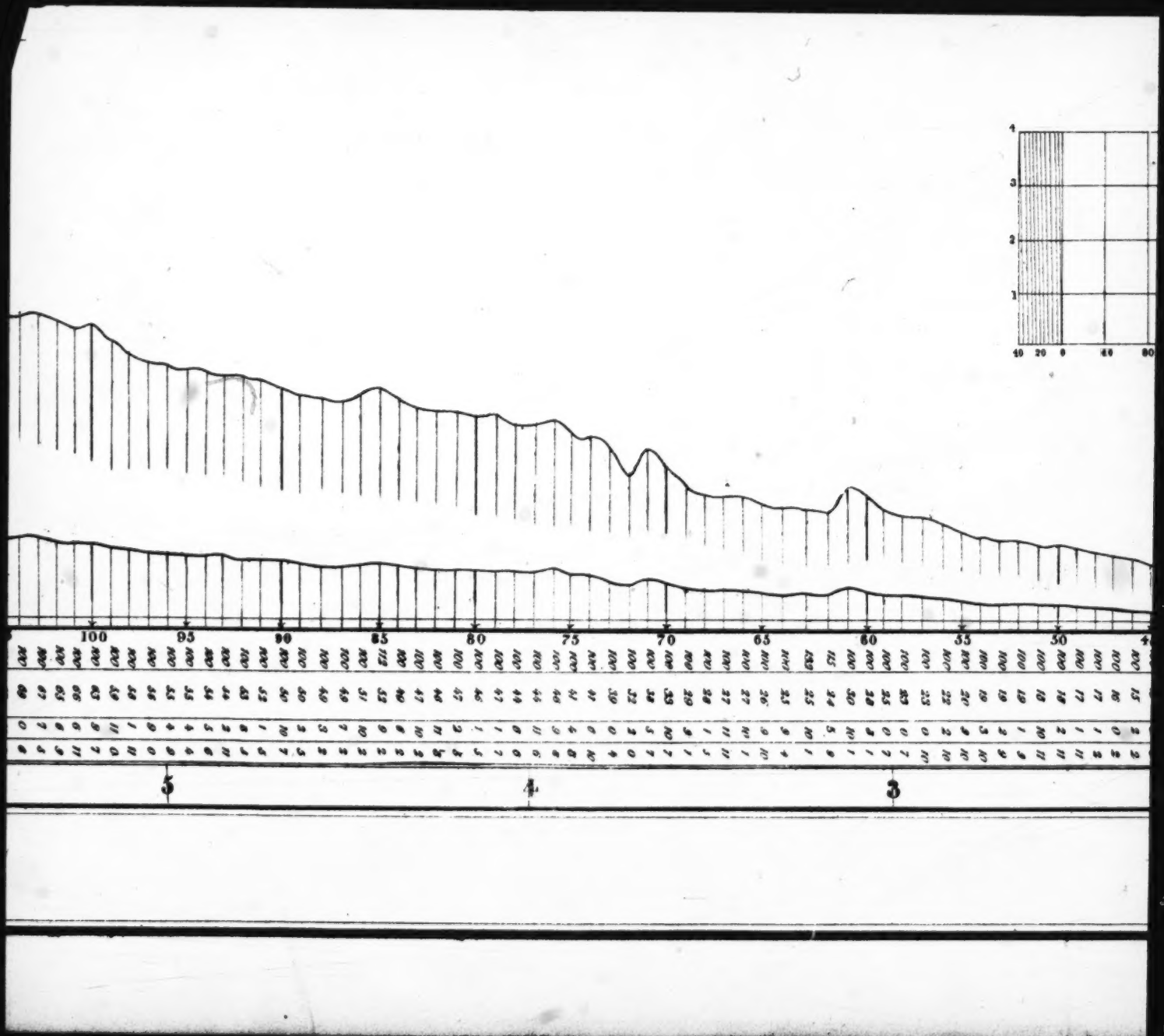
Vertical Scale for Upper Profile 30 feet to 1 inch.


Level of the Lake
348
345
340
335
330
326
320
315
310
305
300
295
290
17
16
15

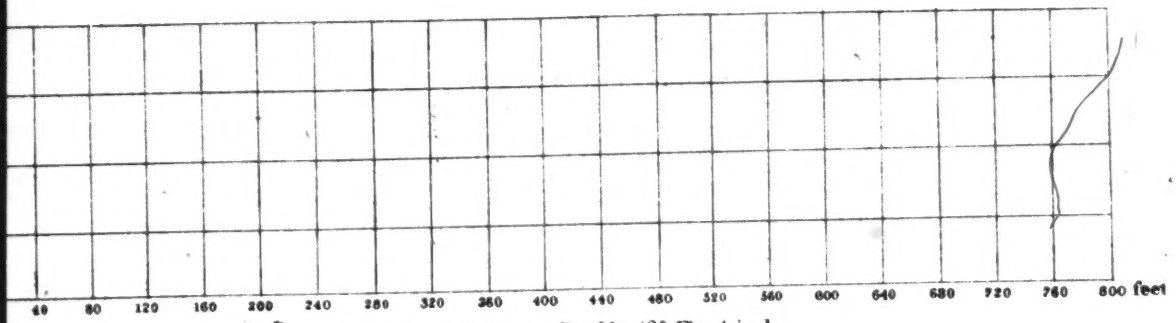

PLANE OF
290
280
275
270
265
260
255
250
245
240
235
230
14
13
12


REFERENCE. LEVEL OF THE SOUT
230 225 220 215 210 205 200 195 190 185 180 175 170 165 160
11
10
9


U T H S E A
160
155
150
145
140
135
130
125
120
115
110
105
8
7
6

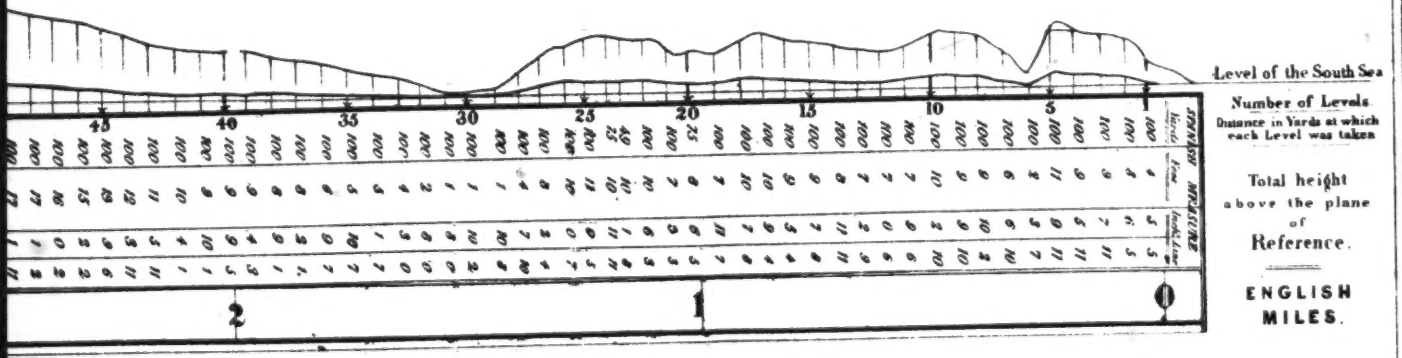

100
95
90
85
80
75
70
65
60
55
50
3
4
3

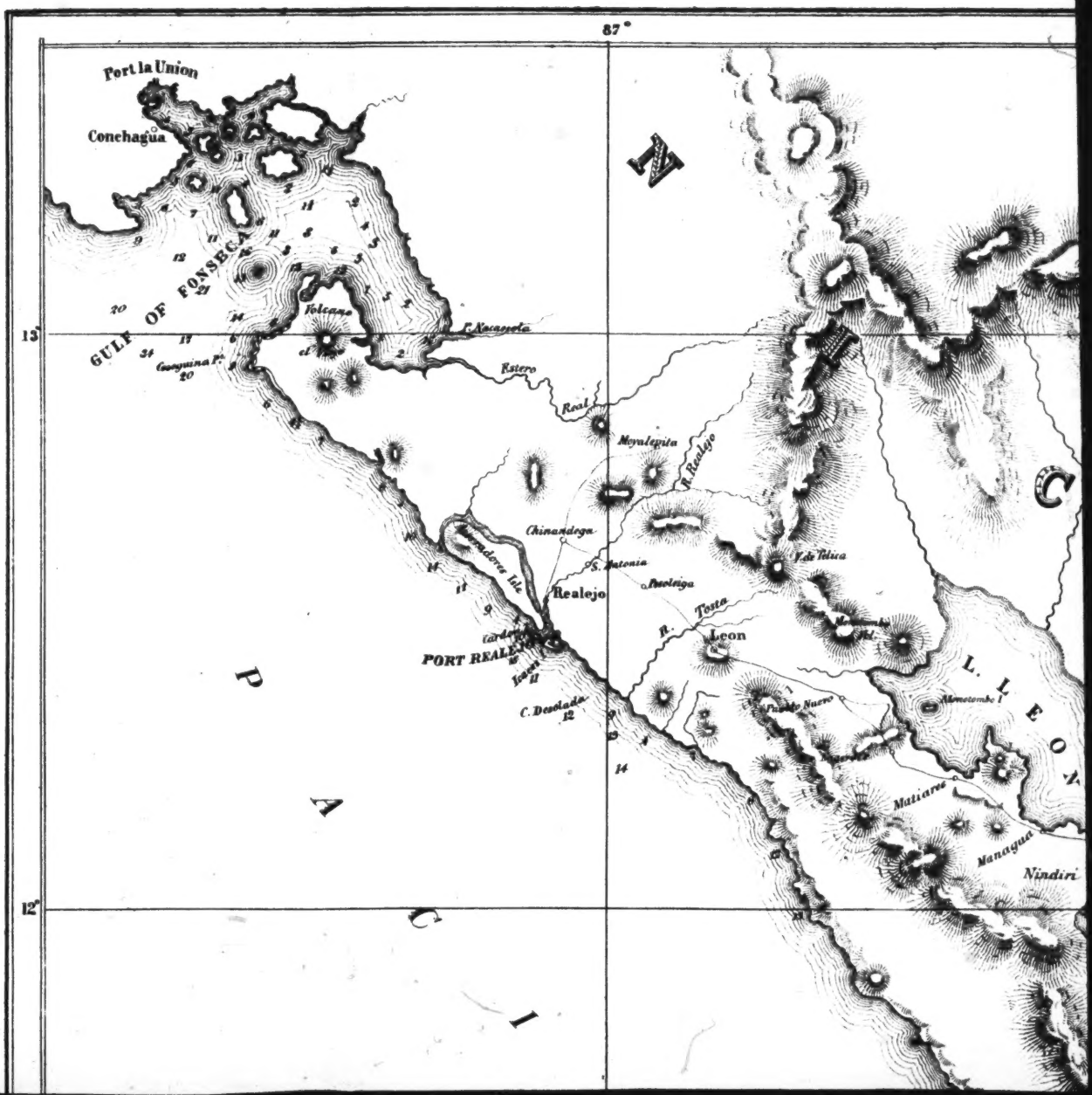
Vertical Scale for Upper Profile 30 feet to 1 inch.

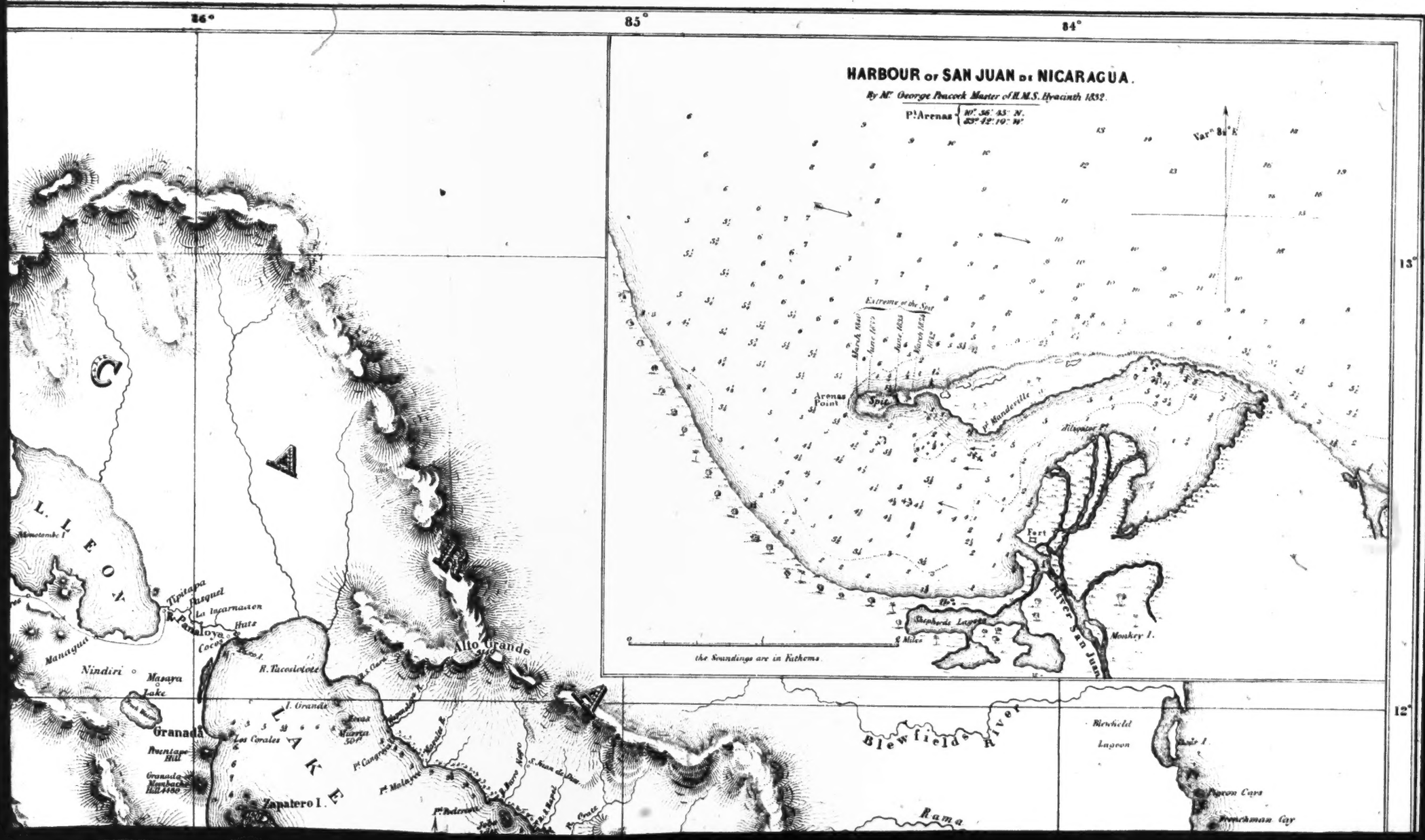


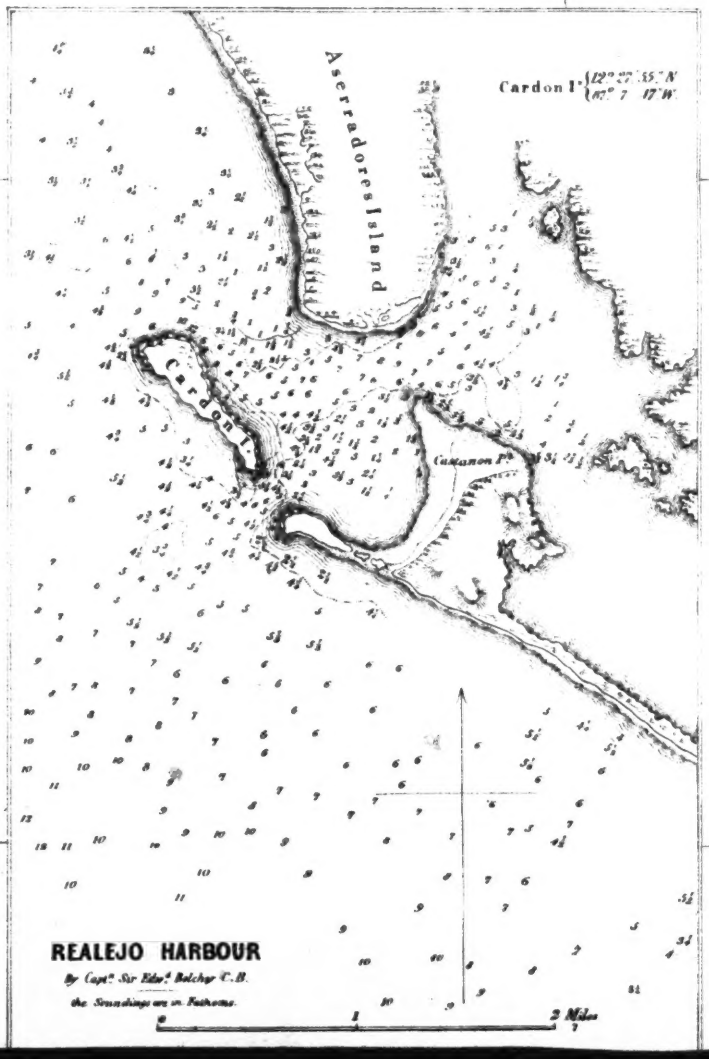
* Vertical Scale for Lower Profile, 120 Ft. to 1 inch.

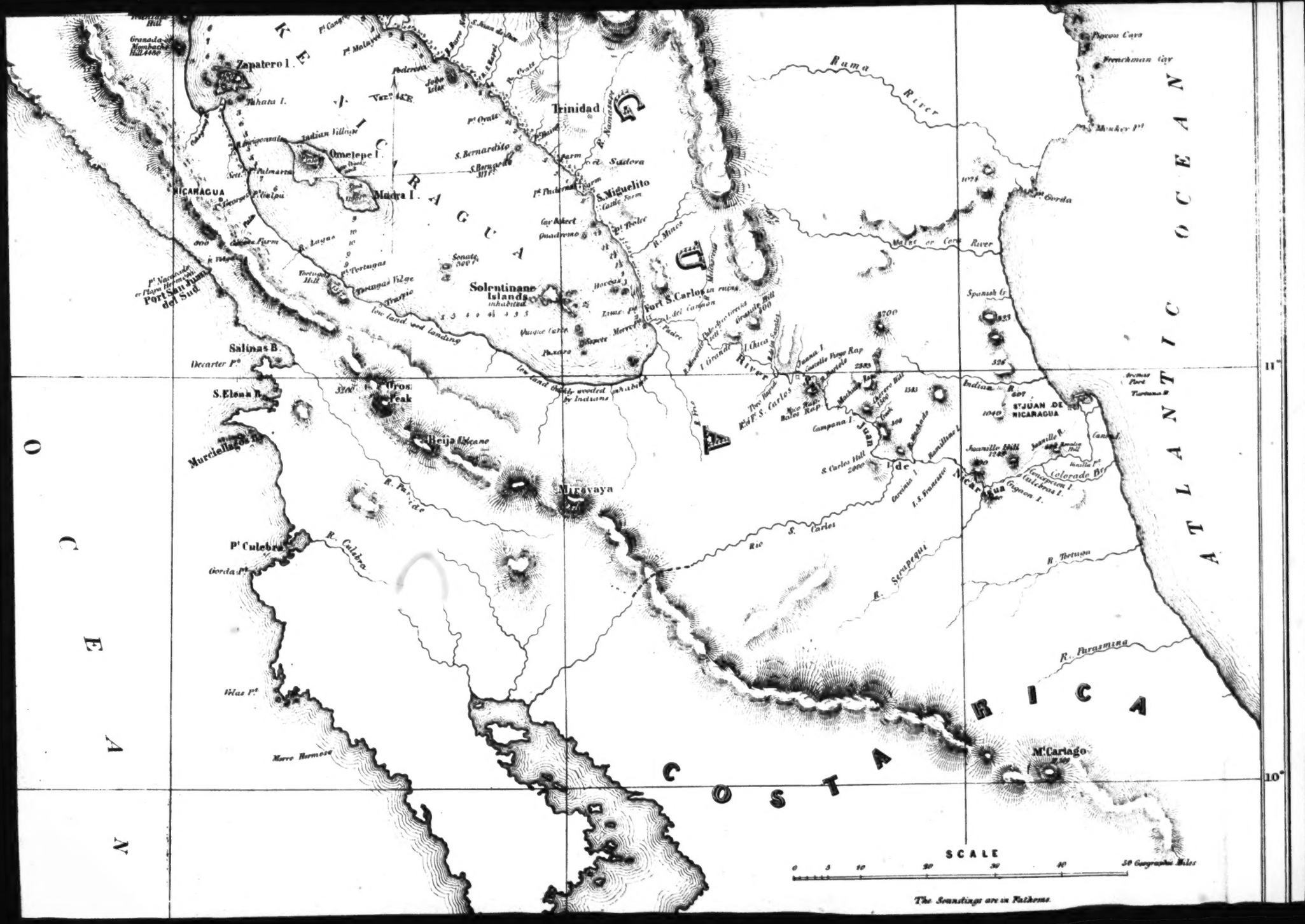
* *Spanish Measures in parts of an English inch*

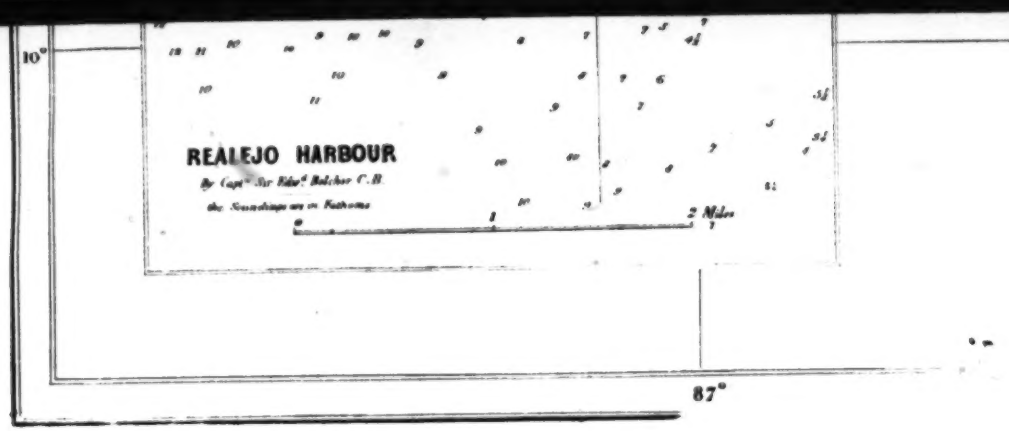



87°
Port la Union
Conchagua
GULF OF FONSECA
Volcano
I. Navagiola
Estero
Real
Moyalepita
R. Realejo
Chinandega
S. Antonia
Realejo
Tosta
R.
Leon
PORT REALEJO
C. Desolada
L. LEON
Matiare
Managua
Nindiri
PACIFIC
13°
12°


86°
85°
84°
13°
12°
HARBOUR OF SAN JUAN DE NICARAGUA.
By Mr. George Peacock Master of H.M.S. Hyacinth 1832.
Pt Arenas { 10° 56' 45" N. 83° 42' 10" W.
Var. 3½° E
Extreme of the Spit
March 1832
June 1832
March 1832
1832
Arenas Point
Spit
Pt Manderville
Pt
Fort
River San Juan
Shepherds Lagoon
Monkey I.
Miles
the Soundings are in Fathoms.
L. LEON
Managua
Nindiri
Masaya
Lake
Granada
Puntiagudo Hill
Granada Mombacho Hill 4450
Zapatero I.
Tipitapa
Pasquel
La Encarnacion
Panaloya
Hato
Cocos
R. Tacoslolote
Alto Grande
I. Grande
Los Corales
Blewfields River
Blewfield Lagoon
Rama
Peacock Cays
Peacock Bay


Aserradores Island
Cardon I.
Cumanon Pt.
REALEJO HARBOUR
By Capt.n Sir Edw.d Belcher C.B.
the Soundings are in Fathoms.
1
2 Miles


Zapatero I.
Ometepe I.
Madra I.
Trinidad
S. Miguelito
Solentinane Islands
Port S. Carlos
Port San Juan del Sud
Salinas B.
S. Elena B.
Murcielago B.
Brija Volcano
Miravaya
P.t Culebra
Gorda Pt.
Blas Pt.
Morro Hermoso
Ruma River
Spanish Cr.
Indian R.
S.t JUAN DE NICARAGUA
Colorado Bk
Mt Carago
R. Tortuga
R. Parasmina
R. Serapiqui
R. Culebra
Rio S. Carles
Rio San Juan de Nicaragua
LAKE NICARAGUA
NICARAGUA
COSTA RICA
PACIFIC OCEAN
ATLANTIC OCEAN
SCALE
0 5 10 20 30 40 50 Geographic Miles
The Soundings are in Fathoms.


10°
REALEJO HARBOUR
By Capt.n Sir Edw.d Belcher C.B.
the Soundings are in Fathoms
2 Miles
87°

N
C O S T
10°
SCALE
0 5 10 20 30 40 50 Geographic Miles
The Soundings are in Fathoms
The Height of the Mountains in Feet
GULF OF
NICOYA
C. Blanco
86°
85°
84°

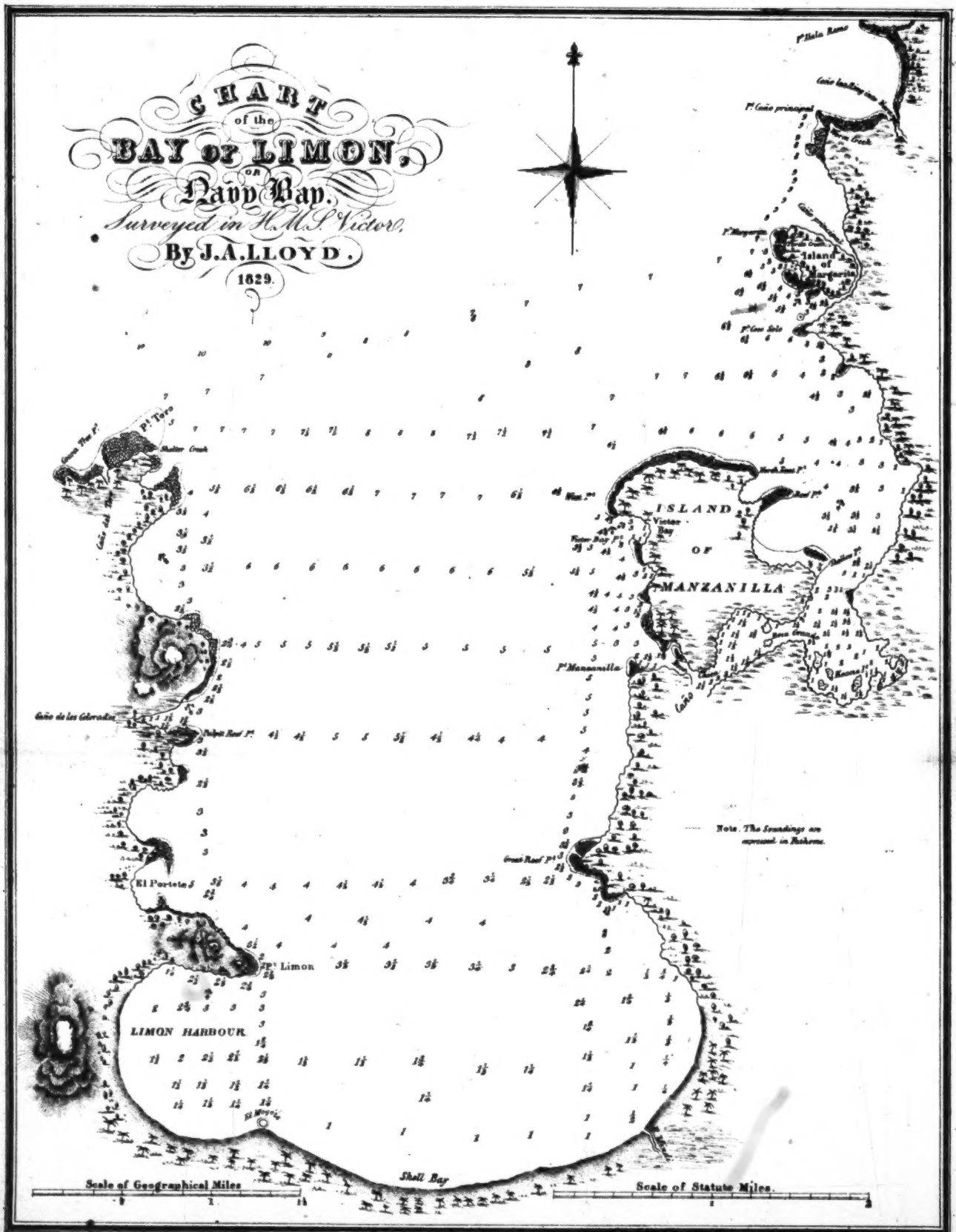
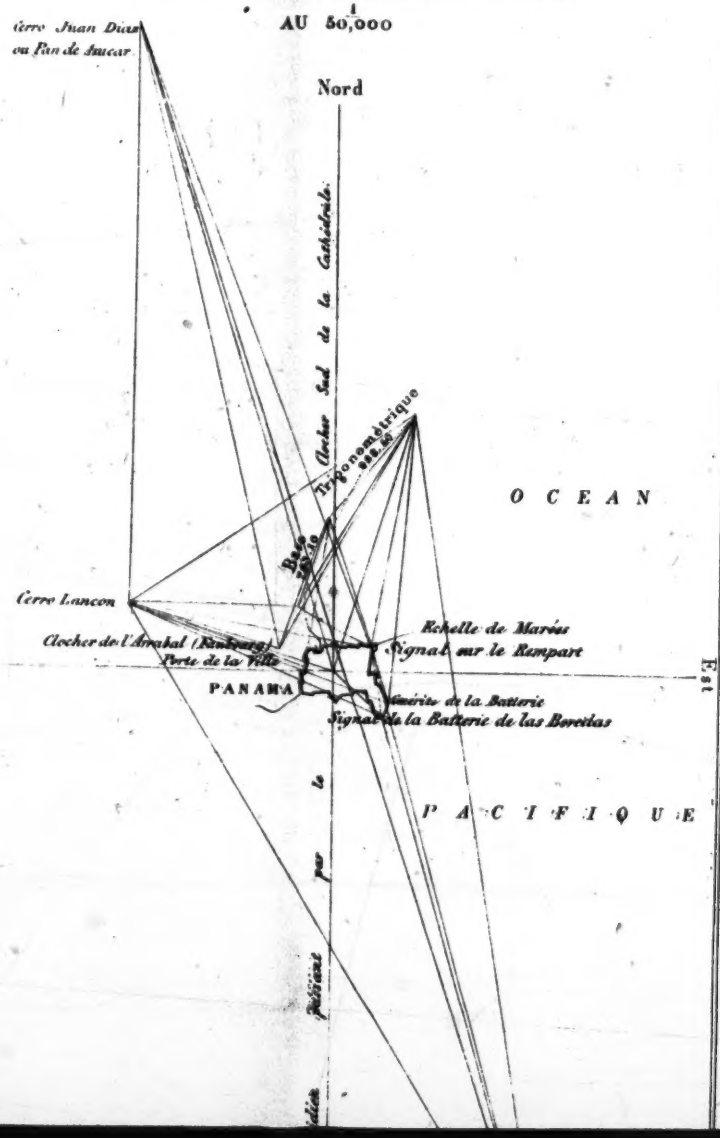


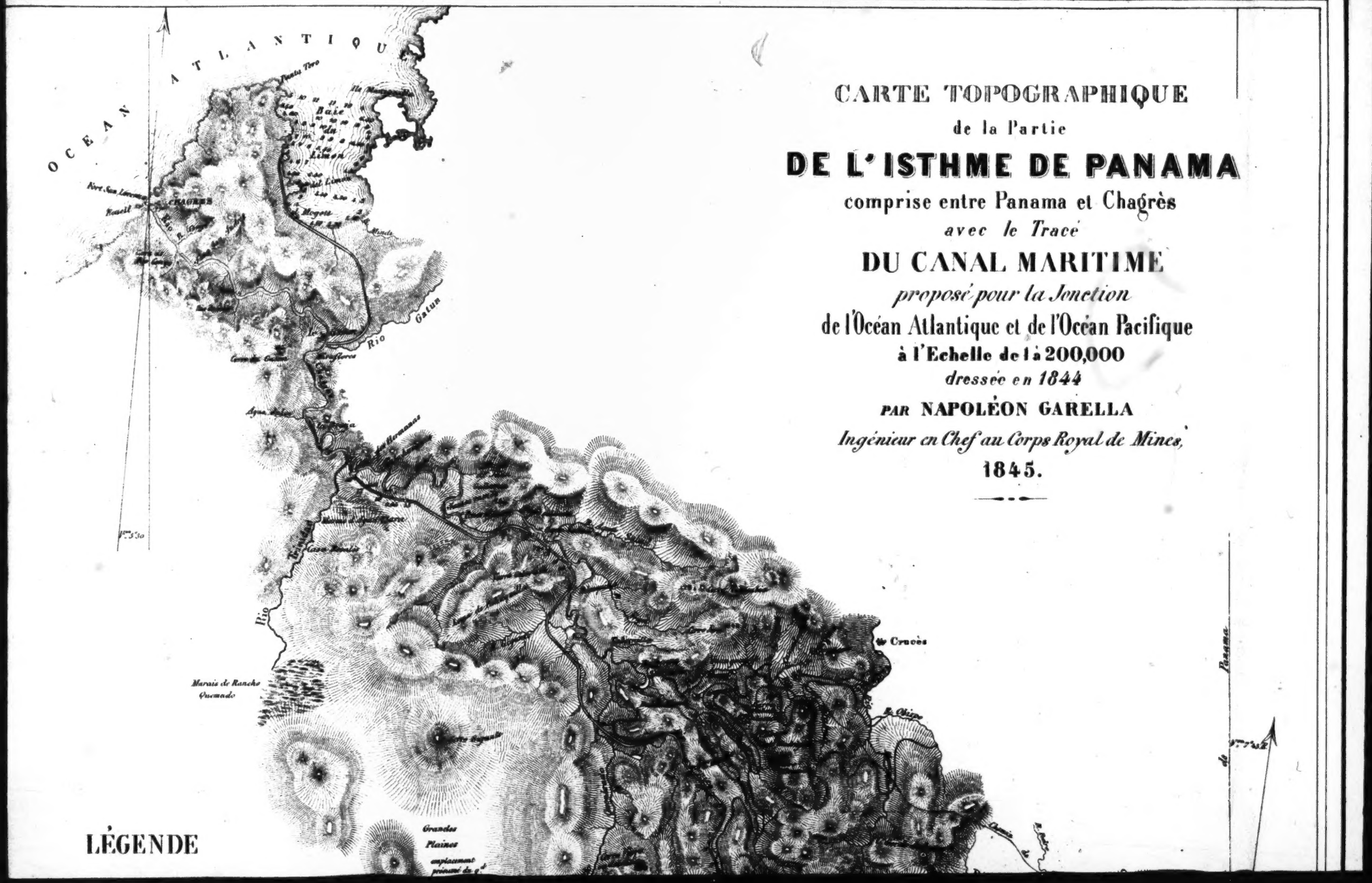
CHART
of the
BAY of LIMON,
OR
Navy Bay.
Surveyed in H.M.S. Victor.
By J.A.LLOYD.
1829.
Island of Margarita
ISLAND OF MANZANILLA
Victor Bay
Pt Manzanilla
Pt Toro
Cabo de las Gloriosa
El Portete
Pt Limon
LIMON HARBOUR
Shell Bay
Note. The Soundings are expressed in Fathoms.
Scale of Geographical Miles
Scale of Statute Miles.

PLAN
DU
CANEVAS TRIGONOMETRIQUE

OPERATIONS AUX ENVIRONS DE PANAMA
AU $\frac{1}{50,000}$



NORD



CARTE TOPOGRAPHIQUE

de la Partie

DE L'ISTHME DE PANAMA

comprise entre Panama et Chagrès

avec le Tracé

DU CANAL MARITIME

proposé pour la Jonction

de l'Océan Atlantique et de l'Océan Pacifique

à l'Echelle de 1 à 200,000

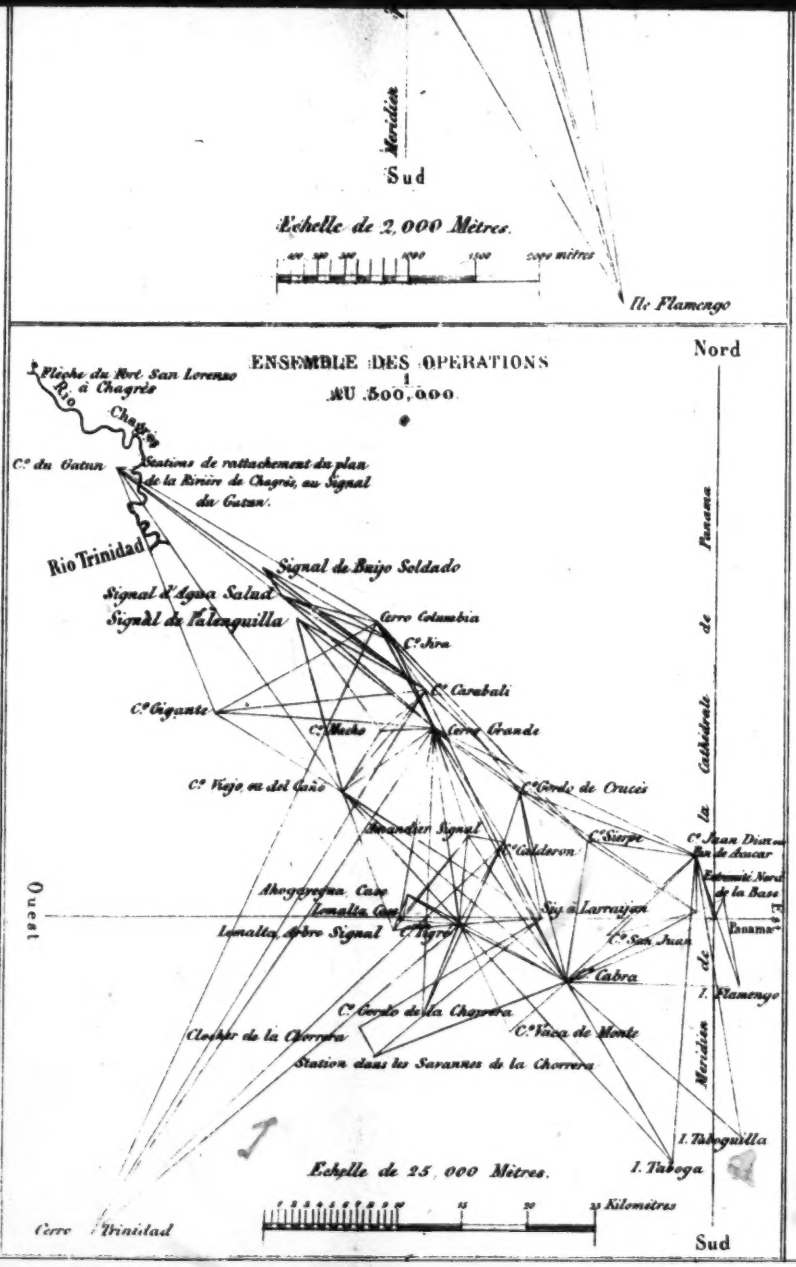
dressée en 1844

PAR NAPOLÉON GARELLA

Ingénieur en Chef au Corps Royal de Mines,

1845.

LÉGENDE



Signaux

Les Chiffres placés

hauteur en mètres au dess

calculés, d'après des observ

Les Chiffres inclin

Tracé du

Rigoles

Ecluses.

de partant sur chaque vers

Chemins.

Les Sondes sont expri

Celles de l'Océan Paci

la Danaïde, commandé par

au niveau de la basse Mer.

Celles de la Baie du

en 1829, partie en 1844 p

par M.r Sochet, Capitaine d

La déviation de l'Ai

de la Danaïde, est de

A Chagres, d'après le

1844, elle n'est que de

Du Sommet du Cerro

LÉGENDE

Signaux trigonométrique.

iffres placés à côté des Signaux indiquent leur
tres au dessus des hautes eaux de l'Océan Pacifique
ie des observations barométrique.

iffres inclinés indiquent des cotes de nivellement

Tracé du Canal proposé.

Rigoles d'Alimention.

Ecluses. les numéros des Ecluses, partant du Bief
r chaque versant, sont indiqués par des Chiffres arabes.

Chemins.

NOTA.

les sont exprimées en Mètres.

l'Océan Pacifique ont été prises en 1840 par les Officiers de la Corvette
mandé par M.r de Rosamel, Capitaine de Corvette. Elles sont rapportées
la basse Mer.

la Baie du Limon (Océan Atlantique), ont été prises partie par M.r Lloyd
en 1844 par les Officiers du Brick de guerre, le Papillon, commandé
, Capitaine de Corvette.

ation de l'Aiguille aimantée observée à Panama en 1840 par les Officiers
est de ——— 7°45'E.

is, d'après les observations des Officiers du Brick le Papillon, faites en
t que de ——— 5°30'E.

met du Cerro Grande, on aperçoit les deux Océans.

Grandes Plaines

emplacement présumé du g.d lac de Vino tinto.

Isla Trinidad

Col de las Piedras 180

Col del Escobel 126.50

Col de la Yava 129.50

la Chorrera

Rio Grande

Rio Caimito

Rio Chagres

Rio Trinidad

Cordillère

PANAMA

Bouche du Caimito

I. Taboga

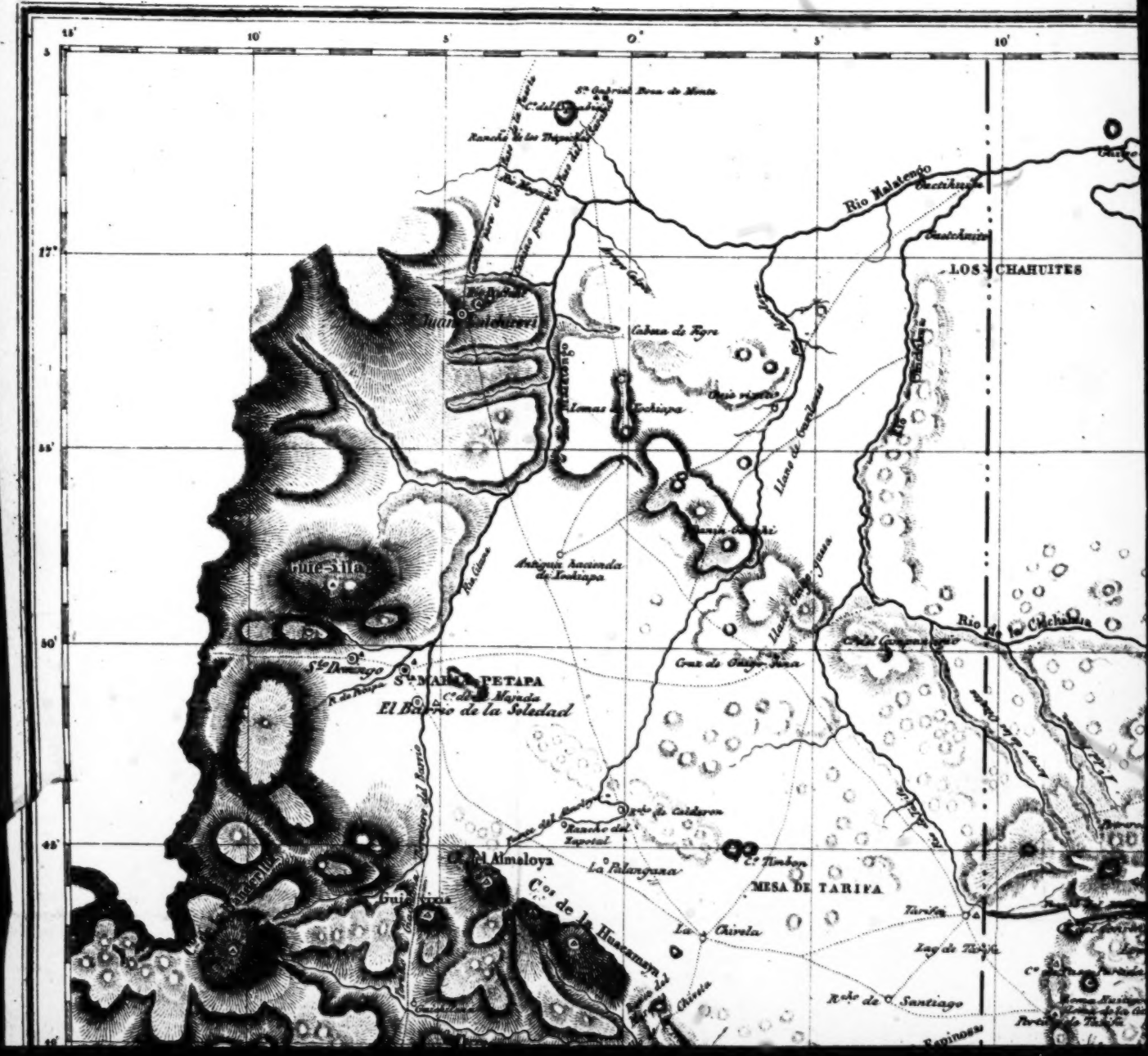
OCEAN PACIFIQUE

Echelle de 20,000 Mètres.

0 1000 5000 5000 10.000 15.000 20,000 Mètres

Meridien

SUD


15'
10'
5
0°
5'
10'
Rio Valsequillo
LOS CHAHUITES
Cabeza de Tigre
Llano de Guadalupe
Antigua hacienda de Tochtepec
Rio de la Chichahua
Cruz de Guiengola Vieja
Sto Domingo
S. MARIA PETAPA
El Barrio de la Soledad
Rancho del Zapotal
La Palanguna
MESA DE TARIFA
Tarifa
Rancho de Santiago
Rio del Barrio
Rio Chima

REPÚBLICA MEXICANA

PLANO

DE LA

PARTE AUSTRAL DEL ISTMO

DE

TEHUANTEPEC

DESDE LA COSTA DEL OCEANO PACÍFICO

HASTA LA LLANURA DEL COATZACOALCOS

Levantado por disposicion de Dn. JOSÉ de GARAY empressario de la comunicacion OCEÁNICA por la comision cientifica nombrada al efecto

1843.

G. Moro

SIGNOS.

- CABECEROS DE PARTIDO
- Pueblos
- Rancherias
- Haciendas
- Ranchos
- Jacales aislados
- Camino que sigue al Correo
- Veredas
- Puntos trigonometricos de primera clase
- Puntos trigo.s de segunda y tercera clase
- Longitud y Latitud observadas astronomicamente
- Latitud observada

Los números de los ondeos de las Lagunas expresan metros

15' 20' 25' 30' 35' 40' 45'

5' 17° 55' 50' 45' 40'

Rio Coatzacoalcos ó del Corte

Sa. María Chimalapa

Rio de Chiapa

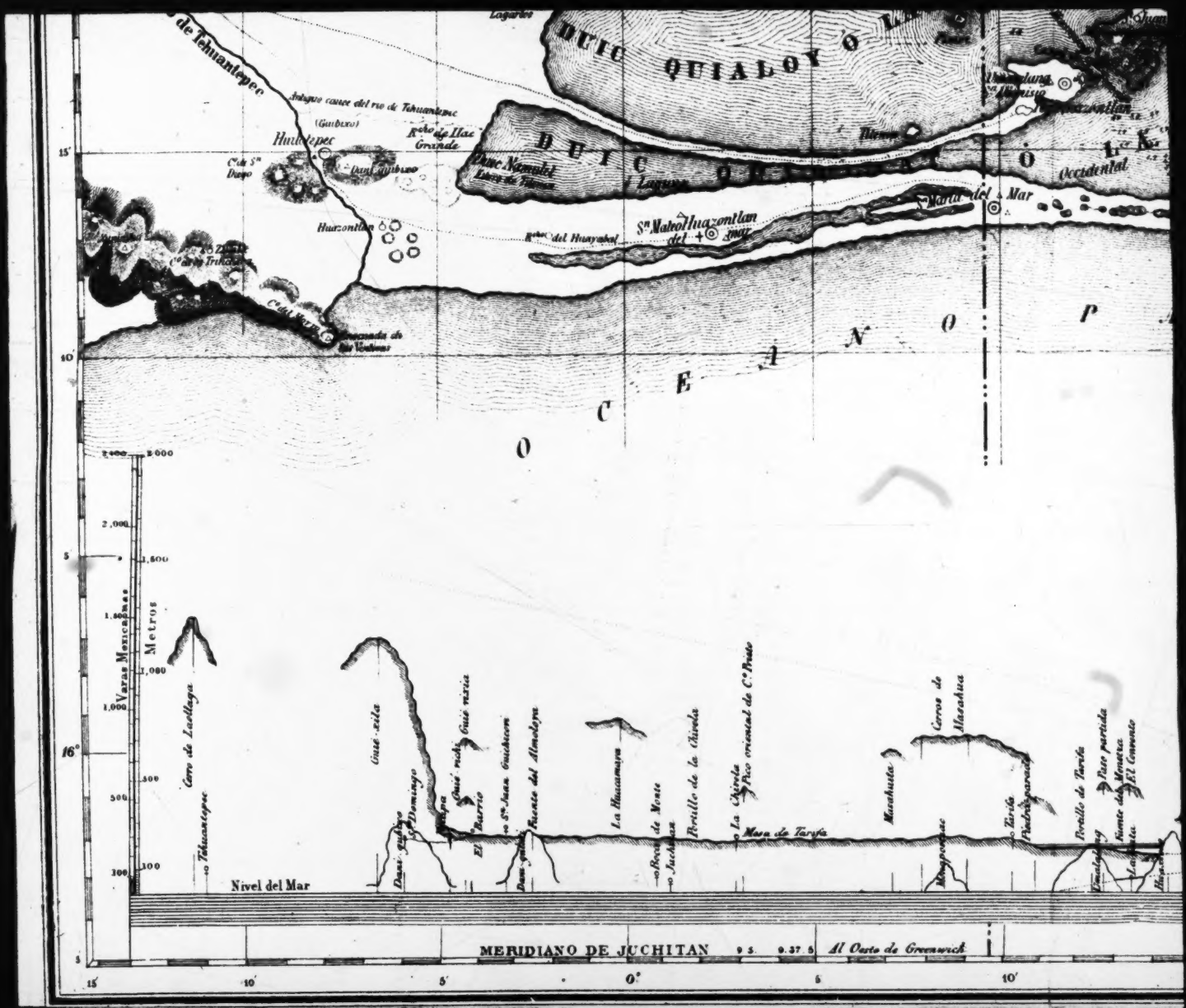
Rio de Chicapa

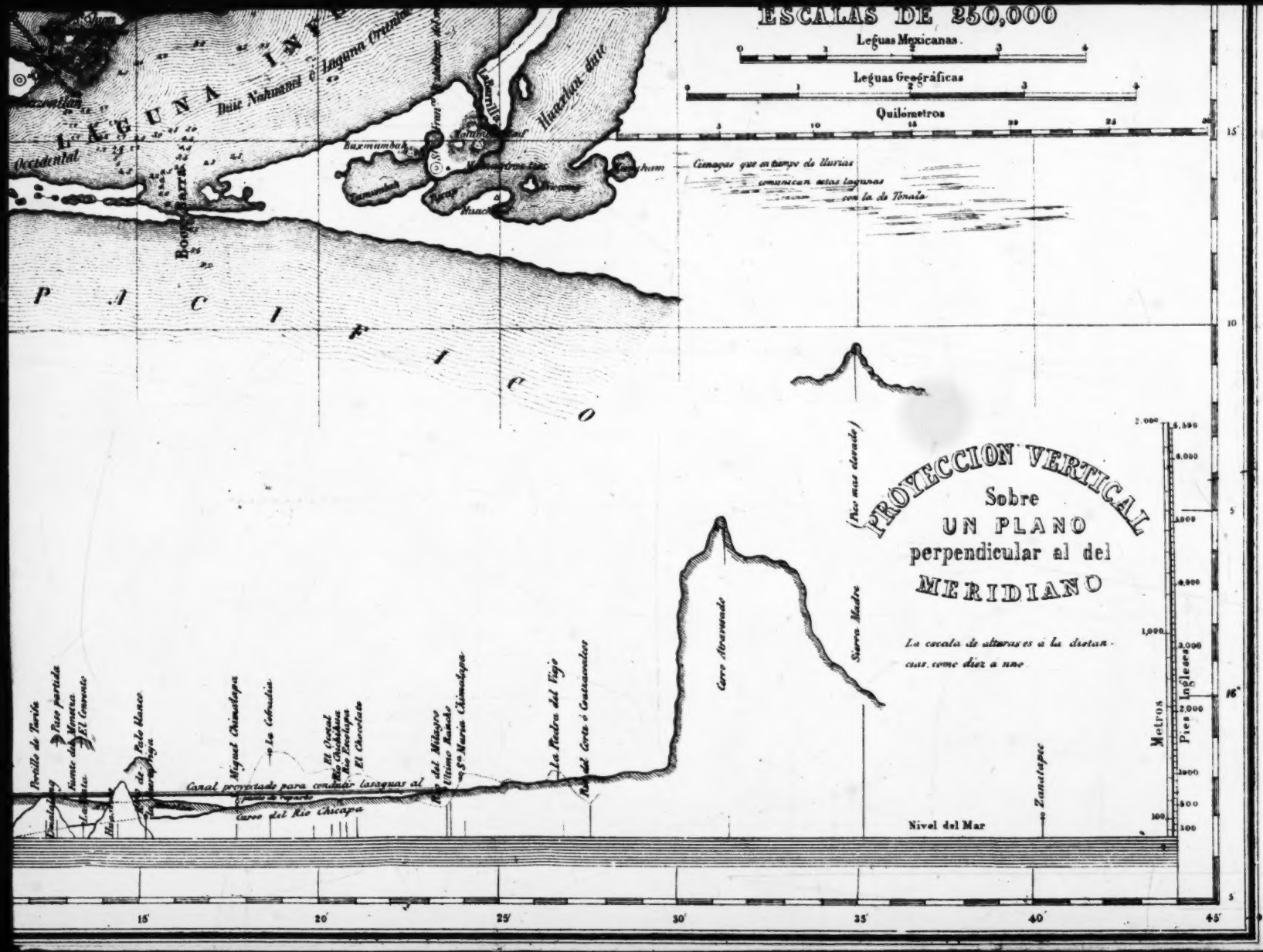
Rio de los Naranjos

Rio Alvarado

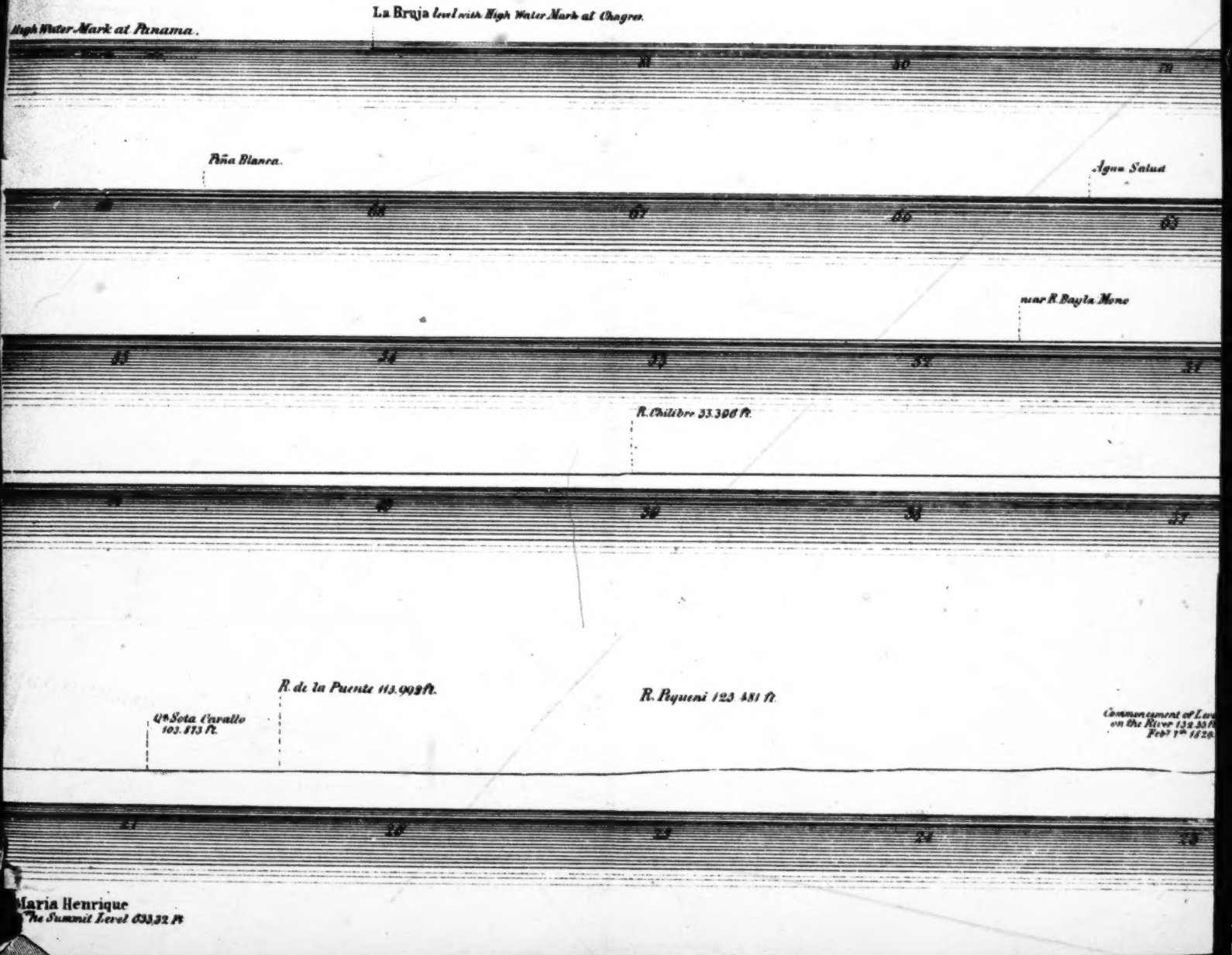
La Chirela
Lag.a de Tarifa
Rcho de S.t Santiago
Cerros de Mazahua
Fuente de la Agua Caliente
Río de los Perros
Chihuitan
Vixahuí
S.n Gerónimo
Loma de la Mogada
Cerro de Laollaga
La Cienaga
Itztaltepec
El Espinal
La Estradita
95° OESTE DE GREENWICH
Río de Chicapa
JUCHITAN
Salinas de Jachitan
Río de Juchitan
La Mistequilla
TEHUANTEPEC
Río de Tehuantepec
LAGUNA SUPERIOR
LAGUNA INFERIOR
QUIALOY Ó

Río de Chicapa
Río de Chiapa
Río de Niltepec
Río de Zutnapa
Río Xoconapa
Río de Ostuta
Río de Tonalá
Río Huazuntlan
Río Tancochapa
Río Tancochapa
Río Tancochapa

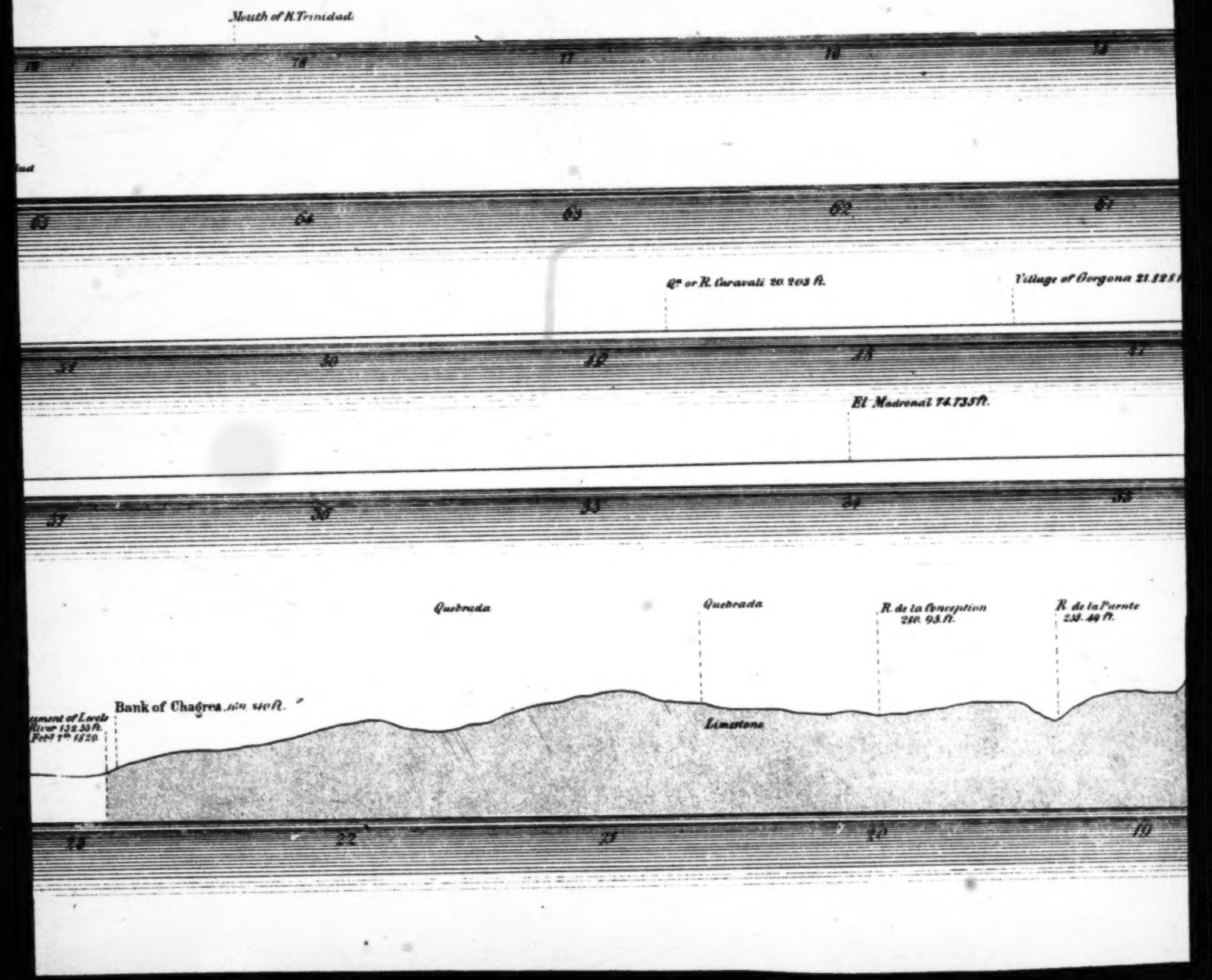

de Tehuantepec
Antiguo cauce del rio de Tehuantepec
(Guibixo)
Huilotepec
Rcho de Hac Grande
Punc. Nanahuat
Lagunas
DUIC QUIALOY O L.
Occidental
Huazontlan
Sta Maria del Mar
Sn Mateo Huazontlan
Rcho del Huayabal
Hurzontlan
Cerro de Tehuantepec
Cerro de Lachiguiri
Cerro de Lachiguiri
Cerro de Lachiguiri


ESCALAS DE 250,000
Leguas Mexicanas.
Leguas Geográficas
Quilómetros
LAGUNA
Occidental
Barmumbah
Cimayas que en tiempo de lluvias comunican estas lagunas con la de Tonalá
PACIFICO
PROYECCION VERTICAL
Sobre
UN PLANO
perpendicular al del
MERIDIANO
La escala de alturas es á la distancias, como diez á uno
(Pico mas elevado)
Sierra Madre
Cerro Abramado
Nivel del Mar
Zanatepec
Metros
Pies Ingleses
Canal proyectado para conducir lasaguas al
Cauce del Rio Chiapa
Pueblo de Tonalá
Pinole
Pinole de Pato blanco
Miguel Chimalapa
La Cebadilla
El Chocolate
La Piedra del Tigre
15'
20'
25'
30'
35'
40'
45'

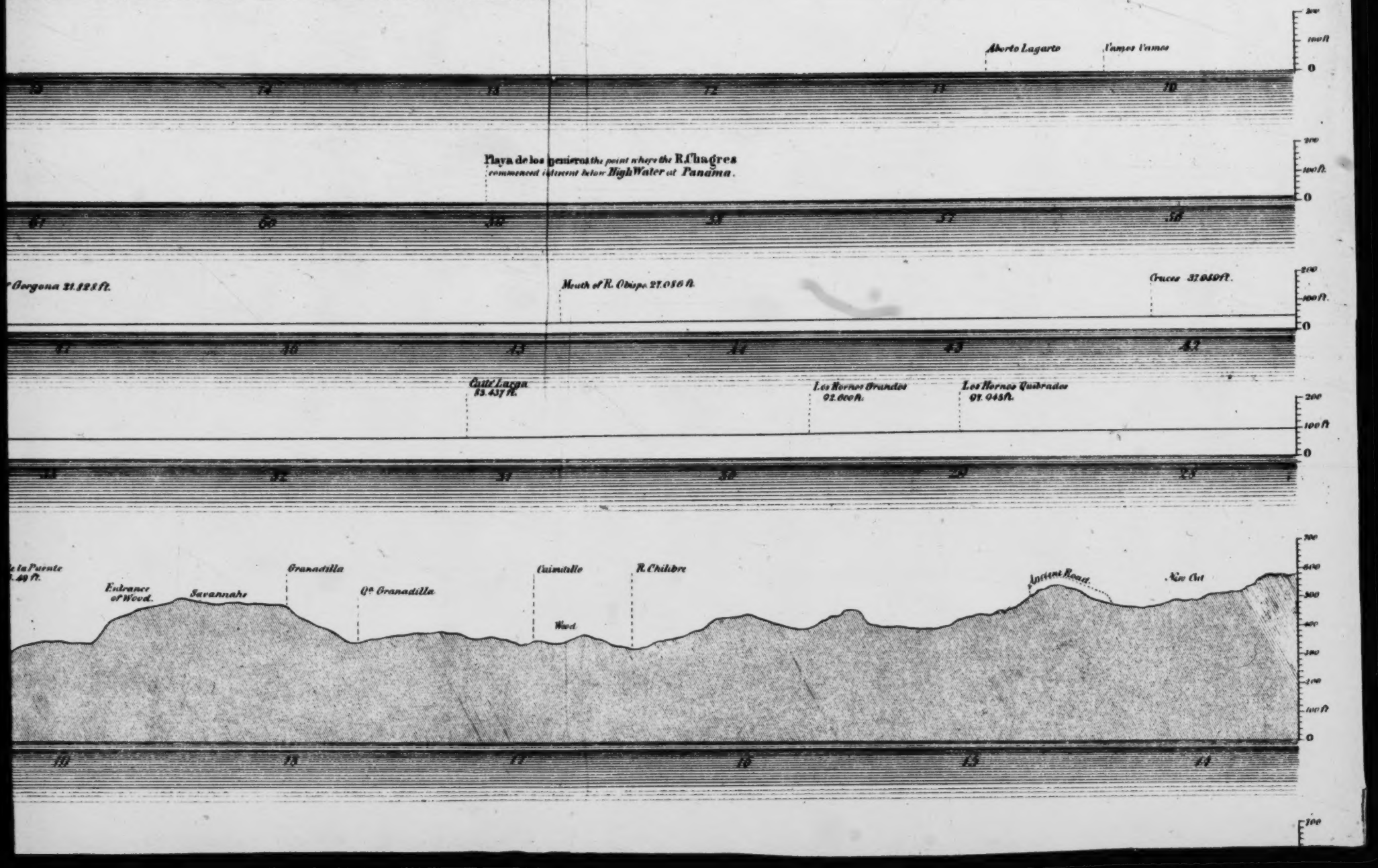
SECTION OF THE COUNTRY P

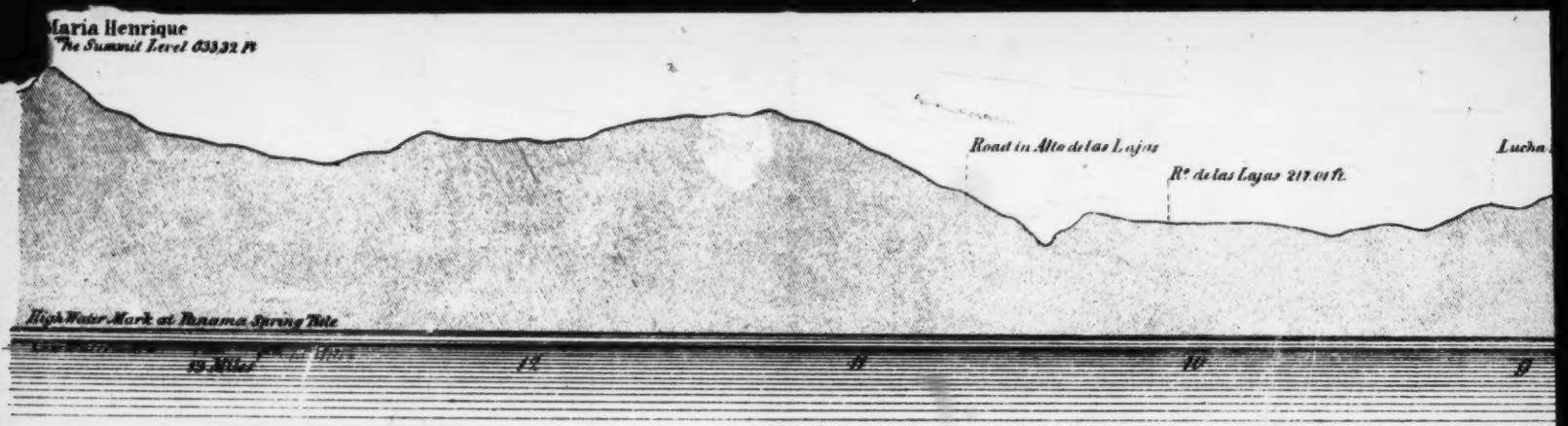

High Water Mark at Panama.
La Bruja Level with High Water Mark at Chagres.
Peña Blanca.
Agua Salud
near R. Bayla Mono
R. Chilibre 33.396 Ft.
R. de la Puente 113.993 Ft.
R. Pequeni 123 581 Ft.
Ue Sota Cavallo 103. 613 Ft.
Maria Henrique
The Summit Level 633.32 Ft

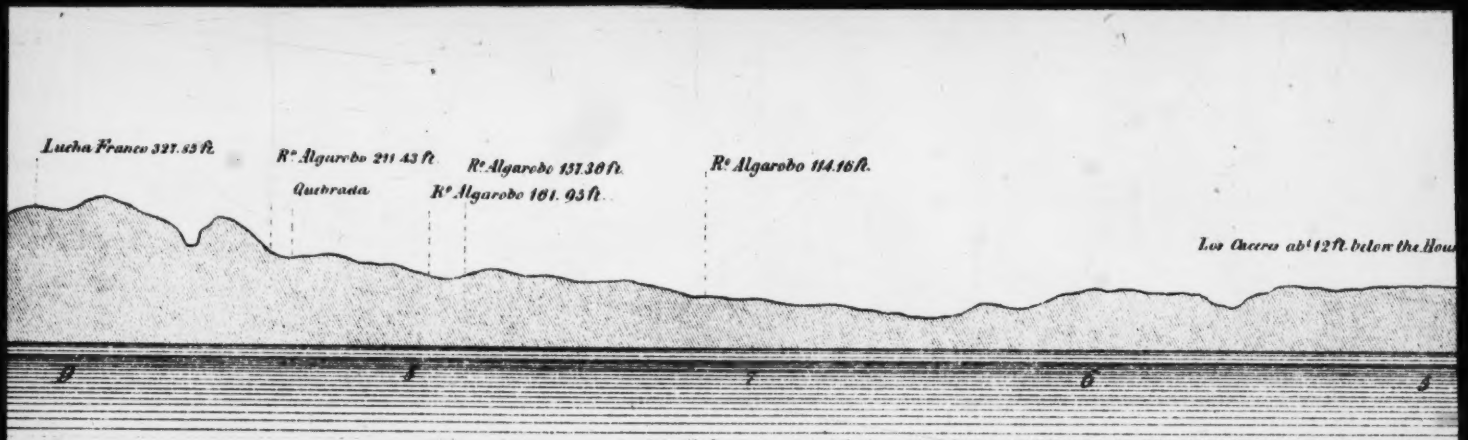
RY PASSED OVER IN ASCERTAINING THE DIFFERENCE OF LEVEL BETWEEN

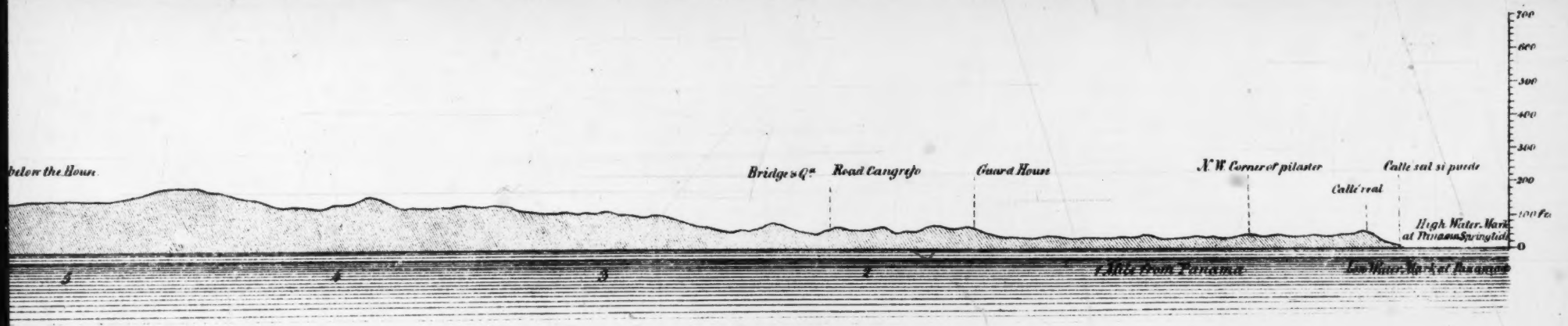


TWEEN THE PACIFIC AND ATLANTIC OCEANS.




Maria Henrique
The Summit Level 635.32 Ft
Road in Alto de las Lajas
Rd. de las Lajas 217.01 Ft.
Lucha
High Water Mark at Panama Spring Tide
13 Miles
12
11
10
9


Lucha Franco 327.83 ft.
Rº Algarobo 211.43 ft
Quebrada
Rº Algarobo 131.38 ft.
Rº Algarobo 161. 93 ft.
Rº Algarobo 114.16 ft.
Los Caceres abt 12 ft. below the Hou
9
8
7
6
5


700
600
500
400
300
200
100 Ft.
0
below the House
Bridge's Qr.
Road Cangrejo
Guard House
N.W. Corner of pilaster
Calle real
Calle sal si puede
High Water Mark at Panama Springtide
3
4
3
4
1 Mile from Panama
Low Water Mark at Panama

APPENDIX No. 2.

Comparison between voyages to be made through the canal of Nicaragua and those actually made via Cape Horn and the Cape of Good Hope:

The following documents, which we reproduce with only a few alterations, have been kindly given to us by Mr. Wittich, a professor at the London University.

§ 1.—*From England to Valparaiso, via Cape Horn.*

	Distance in miles.	Days required.
From England (Plymouth) to the Canaries.... [Variable winds; southwesterly and northwesterly prevail. A regular current, of moderate strength, south of 42 degrees north latitude, sets towards the south.]	1,400	14
From the Canaries to the region of the calms, or 6 degrees north latitude, leaving Cape de Verde islands to the eastward..... [Northeasterly trade winds; not quite regular, nor blowing always with force. Current running with considerable force south or southwest.]	1,500	14
From 6 degrees north latitude to the equator, through the region of the calms..... [The region of the calms varies from 2° to 10° of latitude in width; its average breadth is 5¼°. Calms, interrupted by squalls. It takes commonly eight days to pass through it.]	360	8
From the equator to Cape Frio..... [Southeast trade in winter, interrupted frequently by north and northwesterly winds. Near the equator, the equatorial current running west; and, in certain seasons, with great force south of 8 degrees south latitude. The Brazil current setting south, moderate.]	1,500	14
From Cape Frio to 40 degrees south latitude.. [Variable winds; northwesterly and southwesterly prevail at certain seasons; and at others, northeasterly. Slight current setting to the south.]	1,100	12
From 40 degrees south latitude to Statenland.. [Very variable winds; gales from the west. Current running northward with moderate force; [illegible]	1,000	12

	Distance in miles.	Days required
From the eastern cape of Statenland to 60 degrees south latitude and 65 degrees west longitude, and thence round Cape Horn to 89 degrees west longitude.....	840	21
[Southwesterly and northwesterly winds prevail greatly, and blow with great force, except in June and July, when easterly winds are frequent. Current setting to the east, and sometimes with considerable force.]		
From 85 degrees west longitude, and 60 degrees south latitude, to 40 degrees south latitude, close to the meridian of 85 degrees.....	1,250	16
[Northwesterly and southwesterly gales prevail to a great extent. The current is slight, and sets commonly southward.]		
From 40 degrees south latitude to Valparaiso..	450	5
[Southerly winds are almost continual during the summer; in winter, northerly winds prevail to some extent. Current running to the northwest, moderate.]		
	9,400	117

§ 2.—*From England to Valparaiso, via the proposed canal.*

From England to 28 degrees north latitude and 30 degrees west longitude.....	1,600	16
[Variable winds; southwesterly and northwesterly prevail. A slight current south of 42 degrees north latitude, setting to the southward.]		
From 28 degrees north latitude and 30 degrees west longitude to the straits between the island of San Lucia and Saint Vincent.....	2,200	16
[Northeasterly trade winds less regular and weaker towards the old continent, but stronger and more regular near America; setting westward.]		
From the strait of San Lucia to San Juan de Nicaragua.....	1,400	13
[Easterly and northeasterly trade winds in winter, blowing with force; in summer, light and interrupted by westerly winds. Current setting westward, moderate.]		
Passage through the canal.....	278	2
[Towing by steam power through the canal and river, and sailing through the lakes.]		
From Realejo to Guayaquil.....	1,100	20

	Distance in miles.	Days required.
[Very variable winds, commonly light; those from the south more frequent than others; frequent calms, but of short duration. A current setting southwestward from Panama bay to Galapagos.]		
From Guayaquil to Callao..... [The track of the vessel along shore. Southerly winds of moderate strength. Current setting along the shore to the northward; moderate, slow navigation.]	900	18
From Callao to Valparaiso..... [The prevailing winds from south-southeast to southwest; interrupted only by calms, which sometimes continue for three or four successive days; in winter, by light northerly winds. A moderate current sets northward along the coast. The track of the vessel does not lie along the shore, but runs off to the southeasterly trade winds, and, by their aid, the parallel of Valparaiso is obtained. The average passage from Callao to Valparaiso is about three weeks.—Usborne.]	1,500	21
	8,978	106

§ 3.—*Homeward Voyage—Valparaiso to England, via Cape Horn.*

From Valparaiso to 40 degrees south latitude.. [Southerly winds are almost continual during the summer, and in winter they alternate with northerly winds. A moderate current is running to the southwest; as the winds are commonly light and interrupted by calms, the navigation is very slow.]	460	15
From 40 degrees south latitude to Cape Pilares [Northwesterly and southwesterly winds prevail to a great extent, and blow frequently in gales. A slight current runs along the coast southward.]	800	8
From Cape Pilares to the strait of Lemaire... [Westerly and southwesterly winds, except in June and July, when those from the east prevail. Current setting to the east, moderate.]	600	5
From strait Lemaire to 40 degrees south latitude..... [Variable winds, mostly from the west of the meridian; northwesterly gales. Current setting north, with moderate force.]	1,000	13
From 40 degrees south latitude to Cape Frio..	1,100	14

	Distance in miles.	Days required.
[Very variable winds, shifting frequently in a day to all points of the compass, and interrupted by calms; northeasterly gales. Slight current setting to the south.]		
From Cape Frio to the equator..... [Southeast trade, but frequently interrupted by northeasterly and northwesterly winds, especially from November to April. Current setting to the south, and with some force.]	1,500	15
Passage through the regions of the calms..... [Calms, interrupted by short squalls, commonly from northwest and northeast.]	360	8
From the region of the calms to 30° north latitude, and 40° west longitude, in a northwest direction..... [Northwest trade, sometimes interrupted by northwesterly winds; slight current setting to the northwest.]	1,700	17
From 30° north latitude and 40° west longitude in a northeast direction to Plymouth, passing east of the Azores..... [Variable winds; southwesterly and northwesterly prevail.]	1,340	12
	8,860	107

§4.—*Homeward voyage—Valparaiso to England through the proposed canal.*

From Valparaiso to Callao..... [Southerly winds, varying between south-southeast and southwest; in summer interrupted by calms—in winter, by light northerly winds; current setting to the north with force.]	1,500	12
From Callao to Guayaquil..... [Southerly winds constant, and sometimes blowing with force; a current of considerable force setting in to the northwest.	900	8
From Guayaquil to Realejo..... [Variable and light winds—those from the south and southeast prevail; short calms; slight current setting to the southwest.]	1,100	11
Passage through the canal.....	278	2
From San Juan de Nicaragua to the windward passage..... [In the Caribbean sea, easterly and northeasterly trades are always met with.]	650	7
From the windward to Plymouth.....	3,600	36
	8,028	76

§5.—*From England to Callao, via Cape Horn.*

	Distance in miles.	Days required.
From England to Valparaiso (as before)..... [See § 1.]	9,400	117
From Valparaiso to Callao..... [Southerly winds in summer, commonly light and frequently interrupted by calms; in winter alternating with northerly winds, also light; current setting along the shores northward; quick and easy navigation.]	1,500	13
	10,900	130

§6.—*From England to Callao via, the proposed canal.*

From England to San Juan de Nicaragua..... [See § 2.]	5,200	45
Passage through the canal.....	278	2
From Realejo to Callao..... [See § 2.]	2,000	38
	7,478	85

§7.—*Homeward voyage from Callao to England, via Cape Horn.*

From Callao to Valparaiso..... [See § 2.]	1,500	21
From Valparaiso to England..... [See § 3.]	8,860	107
	10,360	128

§8.—*Homeward voyage from Callao to England, via the proposed canal.*

From Callao to Realejo..... See § 4.]	2,000	19
Passage through the canal.....	278	2
From San Juan de Nicaragua to England.....	4,250	42
	6,528	63

§9.—*From England to the Oregon territory, via Cape Horn.*

From England to Callao..... [See § 5.]	10,900	130
From Callao to Oregon.....	3,000	30
	13,900	160

§ 10.—*From England to Oregon, via the proposed canal.*

	Distance in miles.	Days required.
From England to Realejo	5,478	47
From Realejo to Oregon	2,700	27
	8,178	74

§ 11.—*From England to Sydney, via the Cape of Good Hope.*

From England (Plymouth) to the Canaries	1,400	14
[Variable winds—southwesterly and northwesterly prevail; a regular current of moderate strength is found south of 42° northeast, setting south.]		
From the Canaries to the region of calms	1,500	14
[Northeast trade, not very regular, nor blowing always with force; current running with considerable force south-southwest.]		
Through the region of the calms	360	8
[This region extends at an average of 5° and a half in width, and it commonly takes eight days to pass it, as the continual calms are only interrupted by short, though frequent squalls.]		
From the equator to the island of Trinidada	1,220	11
[Southeast trade, blowing rather from the eastern quarter, steady; but in winter frequently interrupted by northwesterly and northerly winds. Near the equator, a current running west, and at times with great rapidity.]		
From Trinidada to the cape, passing north of the island of Tristan d' Acunha	3,250	28
[As far as 28° south latitude, the southeast trade, with a westerly drift current; south of 28° south latitude variable winds, among which those from the west prevail greatly; east of Tristan d' Acunha, a moderate current setting to the east.]		
From the cape to Bass's strait between 38° and 40° south latitude	5,850	53
[Variable winds—westerly and northwesterly prevail, and blow commonly with great force; a moderate current running eastward as far as 50° east longitude.]		
From Bass's strait to Sydney	450	5
[Very variable winds; frequent changes; current setting in winter southward, and in summer northward.]		
	14,030	133

§ 12.—*From England to Sydney, via the proposed canal.*

	Distance in miles.	Days required.
From England to Realejo, through the canal.. [See § 6]	5,478	47
From Realejo to the Galapagos islands..... [Slight winds and calms near the continent; variable winds in the open sea, mostly from the south and southeast; current setting southwest, with considerable strength.]	750	8
From the Galapagos past the Marquesas to 150° west longitude..... [Constant southeast trade, blowing with considerable force; current west or southwest, with strength.]	3,600	22
From 150° to 180° west longitude, and 25° south latitude southwestward, through the sea separating the Society, Archipelago, and Cook's islands on the one side, from the Navigation and Friendly islands on the other.. [Southeast trade, rather steady and regular; drift current, running westward.]	2,000	13
From 180° west and 25° south latitude to Sydney..... [Southeast trade; afterwards variable winds; but those from the east and south prevail; weak currents, setting in different directions.]	2,000	15
	13,828	105

§ 13.—*Homeward voyage—Sydney to England, via the Cape of Good Hope.*

From Sydney to southwest cape in Tasmania.. [Variable winds; westerly and northwesterly prevail to some extent; moderate current, running in summer to the north, and in winter to the south.]	700	9
From northwest cape to 110° east longitude, between 42° and 36° south latitude..... [Variable winds; westerly and northwesterly prevail, but not to a great extent; current setting eastward.]	1,800	21
From 110° east longitude to 85° east longitude, between 36° and 28° south latitude..... [Variable winds; westerly prevail, but not to a great extent.]	1,440	18
From 85° east longitude to 50° east longitude, between 28° and 24°..... [Southeast trade constantly, and commonly flowing with force; slight current running west.]	1,950	13
From 50° east longitude to the cape.....	1,810	17

	Distance in miles.	Days required
[Variable winds; easterly and northeasterly prevail, but not to a great extent; current setting to the west.]		
From the cape to St. Helena..... [Northwesterly and westerly winds prevail south of 28°, and north of that parallel; southeasterly trade winds, hanging for the most part to the south, and even to the southwest; slight current, setting to the northwest.]	1,700	12
From St. Helena to the equator..... [Constant southeast trade; slight current, setting to the northwest; near the line, a strong current setting to the west.]	1,400	9
Through the region of the calms..... [See § 11.]	360	8
From the region of the calms to 30° north latitude and 40° west longitude..... [Northeast trade, sometimes interrupted by northwesterly winds; slight current running to the northwest.]	1,700	17
From 30° north latitude and 40° west longitude to Plymouth..... [Variable winds; southwesterly and northwesterly prevail.]	1,340	12
	14,200	136

§ 15.—*Homeward voyage—Sydney to England, via Cape Horn.*

From Sydney, round Cape Horn, to the strait of Lemaire, passing south of New Zealand.. [Variable winds; mostly from the west and northwest. In the middle of the Pacific a current setting northeast, occupying 1,500 miles in width.]	6,830	57
From the strait of Lemaire to 40 degrees south latitude..... [See § 3.]	1,000	13
From 40 degrees south latitude to Cape Frio.. [See § 3.]	1,100	14
From Cape Frio to the equator..... [See § 3.]	1,500	15
Passage through the calms..... [See § 3.]	360	8
From the calms to 30 degrees south latitude, and 40 degrees east longitude..... [See § 3.]	1,700	17
From 30 degrees south latitude, and 40 degrees west longitude, to Plymouth.....	1,340	12
	13,830	136

§ 15.—*Homeward voyage—Sydney to England, via the proposed canal.*

	Distance in miles.	Days required.
From Sydney to 120 degrees west longitude, between 36 and 33 degrees south latitude, passing to the north of New Zealand..... [Variable winds; westerly and northwesterly prevail greatly.]	4,500	38
From 120 degrees west longitude, northeastward, to the shores of America, near Coquimbo..... [Variable winds; easterly and southeasterly prevail to some extent. Current setting to the east, with moderate force.]	2,520	23
From the parallel of Coquimbo to Callao..... [Southerly winds; varying between south, southeast, and southwest; in summer interrupted by calms, and in winter by light northerly winds. Current setting to the north, with strength; the track lies close in shore.]	1,300	11
From Callao to Guayaquil..... [See § 4.]	900	8
From Guayaquil to Realejo..... [See § 4.]	1,100	11
Passage through the canal.....	278	2
From San Juan de Nicaragua to windward passage..... [See § 4.]	650	9
From windward passage to Plymouth..... [See § 4.]	3,600	36
	14,848	138

§16.—*Voyage from England to Canton, via the Cape of Good Hope, during the season of the southwest monsoon.*

From England to the cape, along the coast of Brazil, passing near Trinidada and Tristan d'Acunha..... [See § 11.]	7,730	75
From the cape to 105 degrees east longitud , between 39 and 35 degrees south latitude... [Variable winds; westerly and northwesterly prevail to a great extent. Current setting east to 50 degrees east longitude, with force.]	4,320	36
From 35 degrees south latitude to Anjier point, in Sunda strait..... [Southeast trade winds to 15 degrees north latitude, and north of that parallel, southeast monsoon. Current setting northwest.]	1,740	12

	Distance in miles.	Days required.
From Anjier point to Canton, through the Chinese sea..... [Southeast monsoon; frequent short calms in the southern part, between Sumatra and Borneo. The average voyage from Sunda strait to Canton is fourteen days.]	1,800	14
	15,590	137

§ 17.—*Voyage from England to Canton, via the Cape of Good Hope, in the season of the northeast monsoon.*

From England to the cape..... [See § 16.]	7,730	75
From the cape, past the islands of Amsterdam and St. Paul, to 110 degrees east longitude and 32 degrees south latitude..... [Variable winds; near the cape southeasterly winds prevail, but past 40 degrees east longitude, the prevailing winds are from west and northwest. Current setting eastward to 50 degrees east longitude.]	4,620	42
From 110 degrees east longitude, and 32 degrees south latitude, to Allas strait, between Lomboch and Sunbama..... [From 28 to 15 degrees, within the region of the southeast monsoon, but near the continent of Australia, it blows commonly from southwest—between 15 degrees and Allas strait, the northwest monsoon.]	1,560	15
From Allas strait, through the Sallayes passage, to Pitt's strait..... [Northwest monsoon; strong current setting southeast and south.]	1,230	17
From Pitt's strait to the Pelew islands..... [In the region of the calms, the winds are variable, but blow chiefly from the westward, with a very slight current running to the east.]	540	11
From the Pelew islands to Balingtang strait... [Northeast monsoon. Current setting with force to the southwest.]	600	9
From Balingtang strait to Canton..... [Northwest monsoon. Strong southwest current.]	600	6
	16,880	175

§ 18.—*Voyage from England to Canton, via the proposed canal, during the northeast monsoon.*

	Distance in miles.	Days required.
From England to Realejo, through the canal.. [See § 12.]	5,478	47
From Realejo to Canton, between 10 and 20 degrees north latitude, through the Formosa strait..... [Northeast trade winds—northeast monsoon. Current setting to the west, and frequently with force.]	10,360	64
	15,838	111

§ 19.—*Voyage from England to Canton, via the proposed canal, in the season of the southwest monsoon.*

From England to Realejo, through the canal..	5,478	47
From Realejo to the Ladrones..... [Northwest trade wind; moderate current setting westward.]	8,600	54
From the Ladrones to the strait of Balingtang [Southwest monsoon west of 138 degrees east longitude. Current running westward with some force.]	1,200	12
From Balingtang strait to Canton..... [Southwest monsoon. Current setting to the north with moderate foree.]	600	7
	15,878	120

§ 20.—*Homeward voyage—Canton to England, via the proposed canal, during the southwest monsoon.*

From Canton to Formosa strait, and then to 30 degrees north latitude and 139 degrees east longitude..... [Southwestern monsoon, blowing with considerable force. Strong current setting to the northeast.]	1,180	7
From 135 degrees east longitude to 120 degrees west longitude, and between 30 and 35 degrees north latitude..... [Variable winds; southwesterly and westerly prevail to some extent.]	5,250	48
From 120 degrees west longitude, and 30 degrees north latitude, to Realejo.....	3,600	30

	Distance in miles.	Days required.
[Variable winds; northerly, northwesterly, and northeasterly are most frequent; gales occur frequently. A rather strong current runs from December to April southeast, and from May to November northwest.]		
Passage through the canal.....	278	2
From San Juan de Nicaragua to Plymouth.... [See § 8.]	4,250	42
	14,558	129

§ 21.—*Homeward voyage—Canton to England, via the Cape of Good Hope, in the season of the northeast monsoon.*

From Canton, through the Chinese sea, to the equator.....	1,320	9
[Northeast monsoon, blowing with force; strong current setting to the southwest]		
From the equator, through Sunda straits, to 12 degrees south latitude.....	750	5
[Northwest or west monsoon; short calms in the sea between Borneo and Sumatra; current running south, with force.]		
Through the region of the southeast trade winds to 27 degrees south latitude and 50 degrees east longitude.....	3,200	21
[Southeast trade winds, veering much to the east, but sometimes weak and interrupted. Current setting to the west, moderate.]		
From 27° south latitude and 50° east longitude to the cape.....	1,560	14
[Variable winds; southeasterly and southerly prevail; current setting to the west and southwest.]		
From the cape to Plymouth..... [See § 13.]	6,500	58
	13,330	107

§ 22.—*Homeward voyage—Canton to England, via the Cape of Good Hope, during the southwest monsoon.*

From Canton to the straits of Formosa.....	480	4
[Southwest monsoon; current setting to the northeast.]		
From the straits of Formosa to Pitt's strait, passing near the Pelew islands	1,300	16
[Southwest monsoon; current running northeast, near the equator, with force.]		

	Distance in miles.	Days required.
From Pitt's strait to Allas strait..... [Southeast monsoon; current setting to the north.]	1,200	12
From Allas strait to 27° south latitude and 50° east longitude..... [Southeast monsoon, and southeast trade; both veering round to the east.]	3,900	26
From 27° south latitude and 50° east longitude to the cape.....	1,560	14
From the cape to Plymouth.....	6,500	58
	14,940	130

§ 23.—*Voyage from England to Singapore, via the proposed canal, during the northeast monsoon.*

From England to San Juan de Nicaragua.....	5,200	45
Passage through the canal.....	278	2
From Realejo to Balingtang strait..... [Northeast trade to the Ladrones, and afterwards northeast monsoon; current running to the west, and running at some places with force]	9,900	62
From Balingtang strait to Singapore..... [Northeast monsoon; current running southwest with force.]	1,200	8
	16,578	117

§ 24.—*From England to Singapore, via the proposed canal, during the southwest monsoon.*

From England to San Juan de Nicaragua.....	5,200	45
Passage through the canal.....	278	2
From Realejo to the Ladrones..... [Northeast trade; current setting to the west.]	8,600	54
From the Ladrones to Pitt's strait..... [First, northeast trade; then southwest monsoon; short calms; current running in different directions.]	680	7
From Pitt's strait through the Sallayes passage to Gaspar strait..... [Southeast or east monsoon; westerly current; very dangerous navigation.]	2,600	19
From Gaspar strait to Singapore..... [Southeast monsoon—weak; calms.]	380	4
	17,738	131

§ 25.—*Voyage from England to Singapore, via the Cape of Good Hope, in the southwest monsoon.*

	Distance in miles.	Days required.
From England to the cape..... [See § 17.]	7,730	75
From the cape to Anjier point in Sunda strait. [See § 16.]	6,060	48
From Anjier point to Singapore..... [Southeast monsoon, weak; calms.]	560	5
	14,350	128

§ 26.—*Voyage from England to Singapore, via the cape of Good Hope, in the northeast monsoon.*

From England to the cape.....	7,730	75
From the cape past the islands of Amsterdam and St. Paul to 105° east longitude, and between 39° and 30° south latitude.....	4,320	39
From 105° east longitude and 35° south latitude to Anjier point..... [Southeast trade to 15° north latitude, and north of that parallel, northwest.]	1,740	17
From Anjier point to Singapore..... [Northwest monsoon; current setting southwest.	560	6
	14,350	137

(*See the recapitulation on the map No.* 1.)

CORRESPONDENCE, &c.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, June 30, 1849.

SIR: In compliance with your request, I have the honor of sending a copy of my letter to Mr. Markoe. A long standing friendship has existed between Markoe and myself; and, from our frequent conversations on these subjects, he desired me to put my notions in the form of a letter to him. I do not flatter myself that you will find them of much account; but they are at your service.

Roads are intended for the use of man, not to gratify a fancy. They should, therefore, be made in such directions as best subserve his uses, and best promote his interests. These interests of man in his condition of a member of society and government, constitute the interests of masses, and may be considered as embracing three principal and extensive considerations—military, commercial, and political.

Military considerations are those connected with the defence of a country; the aid and assistance of parts threatened with attack, means of transporting men, provisions, arms, ammunition, &c., &c., at least expense and in the shortest time; means of communicating with arsenals and places of deposite; means of communicating with regions which can furnish supplies of men and provisions. These general views evidently indicate that the road should be as short as possible; that it should pass as much as practicable through an inhabited and settled country, or through a country which, from its productiveness and climate, holds out inducments for settlements and cultivation; and that it should not be subject to interruptions from inclemencies of season.

Commercial considerations are those involved in efforts to secure an important trade of distant regions; to make easy the interchange of products between different parts of the country; to the developing of the agricultural, mineral, and manufacturing capacities of the country through which it passes. It should, therefore, communicate with good ports at its extremities, and with as many good ports, or at boatable points on good rivers communicating with ports, as practicable in its course. It should pass through a good (inhabited or inhabitable) country, already settled or holding out inducements to being settled. And as commerce will ever languish and be feeble, if exposed to delays or heavy taxes for transport, a road for commercial purposes should be as short as practicable, and should not be unnecessarily exposed to interruptions from inclemencies of season, or by passing over extended inhospitable regions.

The combinations for a good commercial road would seem,

therefore, to lead to the same results as the combinations for a good military road.

The political considerations which would influence the location of such a road, are those which tend to bind different parts of a country together, by means of easy and rapid intercourse; which connect, encourage, and protect the interests and prosperity of all parts, by one great bond of mutual prosperity and mutual happiness; which make a whole of a people by ties of common interest and common feeling, generated by mutual business and social connexions.

Now it does not appear to me that any means are so well adapted to produce these consequences as easy and rapid communications with different parts of a country. Prejudices are beaten down by them, friendships established and family connexions; and, above all, ties of interest mutually promoting the welfare of different parts, and creating a mutual dependence in welfare on different parts, spread a net-work of good feeling and interest over the whole, indissoluble and ever enduring.

These are the political considerations to which I allude—great moral considerations into which all elevated political considerations resolve themselves, adapted to make the government which adopts them, as the basis of its legislation, as enduring as the world of which it forms a part.

Mankind in masses are conservative, because self-interest generates a conservative feeling in society. Where the interests of the whole are consulted and befriended, this wide spread sentiment of self-interest is consulted and befriended. Causes of discontent can never, under such a system, be extensive, and can, therefore, never produce revolution. And it may be the glory of the great framers of our constitution that, in addition to having given a practical example of a government founded upon the principle of diffusing the greatest happiness to the greatest number, they have at the same time adopted a principle which will make the government as enduring as the world of which it forms a part.

These considerations also appear very clearly to lead to such a road as military and commercial considerations require.

I do not presume to say that all these considerations, military, commercial, and political, are intimately combined in the route for a road which I have indicated in my letter to Markoe; but it does appear to my judgment that this route will not admit of serious deviations in its course from San Diego to the Rio del Norte.

I doubt if as good a route can be found by deviations to the north of that line; but I have no doubt that the route could be improved if we owned the country south of the Gila, and could make occasional deviations in that direction.

It is also clear to my judgment, that from the Gila the road should be carried by the most serviceable and most practicable route to the table land of central Texas and that from some point in the interior of Texas, the great bifurcation of the road to the northern and eastern coast of the United States, and to the southern and eastern coast of the United States, should have its origin.

From the probable point of this bifurcation to the Mississippi, for the southern and eastern coast of the United States, the country is sufficiently known to justify the opinion that there are no unusual or insurmountable difficulties; nor do I believe there exists any difficulties of that kind, from the probable bifurcating point, for the route to the northern and eastern coast of the United States by the way of St. Louis.

A question may be raised whether this part of that route could not be better located on the western than the eastern flank of the Ozark mountains. Careful surveys can alone determine questions of that kind; but my present impressions are in favor of the eastern flank of that range, because it is upon this flank only that boatable tributaries to the Mississippi are encountered, and in consequence that the trade of such tributaries can be accommodated by the road.

Such a road must look to more than the trade of its terminating points, or its usefulness will be rather limited.

The idea of the road, that is of the communication between the Atlantic and the Pacific, is one to which no person can lay claim. It is as old as the earliest discoveries of this country, and will be found to pervade the histories of all the voyages and travels of that time and since. The railroad has turned the course of thought from a canal to a road, and opened many practicable paths by which that old idea may now be realized.

Respectfully, sir, your obedient servant,

J. J. ABERT,

Colonel, corps topographical engineers.

Hon. John A. Rockwell,

Chairman Committee of Congress, Washington.

Bureau of Topographical Engineers,

Washington, May 18, 1849.

Dear Sir: I will endeavor to comply with your request to furnish you with a condensed view of the different routes for connecting the two seas, which have occupied public attention. You will find, however, a lamentable deficiency of exact information, the more singular from the reflection that a knowledge of these routes is of deep and peculiar interest to our country, and has been for many years desired. But spare your reproaches to me or my corps. It has not been in our power to avoid it. The policy of our government has been opposed to it. No officer can visit these countries and meet necessary expenses upon his pay; and every species of extra allowance is denied to him. Many have been anxious to go; but, under such circumstances, their anxiety has been discouraged. And even when on furlough, if coupled with some other employment adapted to eke out expenses, there are difficulties in our laws, which are considered seriously embarrassing, if not prohibitory.

This is truly singular; for to what people is this knowledge so essential, and what better return than the obtaining of it can an officer furnish for his time and pay?

Other nations act differently. You know how many officers of the English, French, Russian, Prussian, and Austrian service have within a few years visited our country, gathering information for their own.

Perhaps in time this policy may be changed, so that we shall not be forever indebted to the reports of foreign officers for the little information we possess even of the regions of Central America.

1st route.—Tehuantepec.

Treated in much detail in No. 108 of the *Union*, of 1847. A ship canal out of the question; a boat canal may be made, but even this depends upon being able to conduct adequate supplies of water to the summit pass, a point not sufficiently determined to justify an impression of more than its probability. A favorable route for a railroad.

Supposing this railroad to connect with the Coatzacoalcos, at the lower end of the island Tacamichapa, being the upper end of sea navigation from the gulf, and with the lagoons of the Pacific, it would probably not occupy a less developed length than 180 miles.*

The gulf bar cannot be considered as affording more than 12 feet of water.

Upon the Pacific side there is no harbor. Vessels cannot be safe until they have entered the lagoons, through the passage of the Bocca bara. This passage is narrow, and not manageable by sailing vessels, except under rare and favorable circumstances.

Tehuantepec bay is represented as shoal and much exposed; dangerous, and subjected to frequent tempests.

2d route.—Isthmus of Honduras, from the Gulf of Honduras to the Pacific.

From this gulf, the bay "d'Yzabal" is said to penetrate into the interior about 50 miles; and from this bay to the Pacific the distance is said to be about 230 miles. The great height of the mountains in this direction is considered as rendering a canal impracticable.

It is said, however, that there is a highly favorable passage, more to the southeast, called the valley of "Comayagua," connecting with Fonseca bay on the Pacific. "Tradition" represents this as a very favorable pass, but there is no reliable information about it. It is barely possible that a boat canal can be made in this direction.

* The length of the road will, of course, depend upon its terminating points, and upon extensions made to lessen the rate of grade. These considerations may make the length vary from 150 to 180 miles.

3d route.—That of Nicaragua.

Of this route I have already furnished you with ample notes.

4th route.—In the province of Veragua, from the Boca del Toro, of the Atlantic, to the bay of Cheriqui of the Pacific.

Spoken of as a carboniferous region. The coal formation is said to extend across the isthmus. The ports on each side excellent. Sufficient information of the route is not possessed to justify any opinions of its peculiarities; but the fact of its being a coal region gives great importance to it, as coal is said to have been found as well on the Boca del Toro as on the bay of Cheriqui, (sometimes called Cherokee,) of the Pacific, as it opens the prospect of a supply of coal for Chagres and for Panama.

5th route.—Isthmus of Panama.

This has always been considered the most favorable route, because of its being the shortest, and the most depressed at the summit pass. It is said the length of a canal in this direction would be less than fifty miles, and the greatest elevation of the summit pass about 360 feet; other authorities expose a summit pass of 330 feet. Good harbors are to found on each side. There is a survey now being made of this route for a railroad, which will, without doubt, exhibit many interesting facts. The French engineer, Garella, made a survey of this route for a canal, but I have not yet had the reading of his report. I have sent for it, and expect it daily. He found it necessary, however, to plan an extensive tunnel, which may be considered as proof that he had not discovered an adequate supply of water, sufficiently elevated, for an open canal.

6th route.—From the Gulf of Darien, by the Atrato of that gulf, and the San Juan of the Pacific.

This is a very long route, and the most favorable view of it is, that a boat canal may be made in that direction.

Upon the whole of all these routes, existing information will not justify the opinion that more than two are deserving of consideration in reference to the question of a canal. These are the Nicaragua route, and the Panama route. On both of these routes I have no doubt that good canals can be made at reasonable cost. But understand me—I do not mean a ship canal from sea to sea, even at Panama, where so many persons have assigned the locality of a thorough cut ship canal. Men too generally allow their wishes to influence their judgment, which, with a want of knowledge on these subjects, are, I think, the reasons why this measure of a thorough cut ship canal has been kept in view. What future investigations may furnish, or what future necessities may justify, regardless of cost, is, of course, out of my power to say; but from

such information as we now possess, I feel justified in the opinion that "a thorough cut ship canal" is a practicable measure *only*, on the supposition that any cost, however enormous, is to be disregarded.

Railroads are to be made over any of these routes, but better and at less cost over the Panama route than over any other.

But now come other very important questions. If we encourage our citizens to expend their money in the construction of railroads or canals over any of these routes, do we not create a moral guaranty of their rights? Would we not be obliged to protect these rights if violated or invaded? Could our government resist the clamor which would be raised on the violation of these rights? And do we not thereby, in the encouragement given, to use an old fashioned phrase, buy a law suit? And may not the prosecution of this law suit be an excessively costly affair?

These are important questions in my judgment, deserving of the most serious consideration.

It cannot be denied that any means which increase our facility of intercourse with our distant "provinces" of California and Oregon are important in their political consequences, and are necessary to the binding of these provinces to the Union. On these accounts all the several lines of intercourse are matters of importance to the United States; matters, it may be said, of vital importance, politically and commercially, and more so to us than to any other nation. But, inasmuch as our encouragement of these projects may entail upon posterity an expensive "law suit," it becomes matter of serious consideration, if all these advantages may not be secured more effectually by some other mode, considering the probable consequences of such a "law suit" may also be secured at a far less cost.

If means of facilitating the passage of any one of these routes were to be accomplished, it is vain to suppose that we should enjoy its advantages without rivalry. This rivalry will lead to collisions. These collisions will require a large and active marine force to protect our trade, and, as an inevitable consequence, the law suit, a war, will follow with some European power. Now, if the cost of such a war be counted in life and treasure, it will be found far to exceed the cost of some means of intercourse which should be free from such consequences.

As preliminary and temporary expedients, these railroads at Panama or Tehuantepec, will without doubt, be highly beneficial, and individual enterprise, exempt from guaranty on the part of our government, might be allowed freely to exercise itself. But such measures should be viewed only as temporary, and it should be a *sine qua non*, in my opinion, that our government should not lend either its moral or fiscal aid, except in favor of some project that should be entirely within our own soil.

I am here reminded that we have already passed beyond this limit, in the treaty with New Grenada of the 12th December, 1846, in which we have gone fully into this matter of guaranty; and I also know it to be the opinion of sound minds that the time is ra-

pidly passing in which we shall have any cause of anxiety about the interference of Europe with American affairs. If this be so, then I have expressed myself with more anxiety than the subject required. But the vista of futurity opens to my view a severe but probable contest about commercial supremacy. These routes across the isthmus may provoke and hasten that contest, whereas a project or route within our own soil would be equally advantageous to our commerce, is of the strongest necessity politically, and would be exempt from those causes adapted to disturb our quiet.

Fortunately, such a project is within our power, which will not only accomplish a junction with these distant provinces in vastly less time, but at a vastly less cost, than would be encountered by any of the other projects and their probable consequences.

I allude to a direct and continuous railroad from the Mississippi, through about the middle of Texas, and by the valley of the Gila to San Diego, on the Pacific. Such a road, at the moderate average speed of 20 miles the hour, would carry its train from the Mississippi to the Pacific in less than four days.

From the Rio del Norte to the Pacific, about 800 miles, is now the frontier line of the United States. Upon this line military posts will have to be established; arms, clothing, provisions, munitions of war will have to be transported. A road will therefore have to be made, for we cannot suppose that our government will persevere in the shockingly absurd and expensive mode of maintaining such a transportation on the back of mules. A road, then, will have to be made—a military road for military purposes—for government purposes. This road will not, of course, be closed to our citizens; it will be open to all traffic and travelling. This military road, then—this road essential to the defence of that frontier—will become, of necessity, a commercial as well as military road. The only question which can be raised in reference to the road is, what kind of road shall it be? Common sense will readily answer this question by saying, the road should be of that kind which admits of the greatest speed and the least cost of transportation. Such a road would be the most efficient for military as well as commercial purposes; and such a road is a railroad. That is, after having graded the road and made the road bed, the most rigid reasoning of economy would be consulted by laying rails upon it.

The consequences of such a road are immense—they probably involve the integrity of the Union. Unless some easy, cheap, and rapid means of communicating with these distant provinces be accomplished, there is danger, great danger, that they will not continue parts of our Union. Then what will become of our great moral power, our great commerce, our infinite resources, &c., &c.? We shall sink into two second rate governments, if we are even able to maintain as good a position as that of second rate.

The great moral opinion of this country is in favor of union from ocean to ocean; and it will be found ready and on the alert to second any sound proposition by which that union will be secured. So strong, so universal, so enthusiastic is that opinion,

that even wild and untenable projects are countenanced by it. No danger, then, that popular support will be wanting to sound and well digested projects. But there is danger, I think, that this opinion would visit with serious indignation the men who should be opposed to any such project.

It is generally admitted that, in the present condition of California and Oregon—I mean in reference to delays and difficulties of communication—they cannot be expected to remain as parts of our Union. What, then, is the remedy? Is it not to remove these difficulties and delays? Certainly, you will say. Well, then, what method so effectual, so certain of success, as a railroad? It is not a mere question about a road; it is a question about our Union—a question upon which our greatest statesmen may well expand their strength, and hope for anything as they befriend it; aye, and fear everything as they are found to oppose it.

But what, you may ask, are my particular notions about this road, its trace, &c. I will briefly explain them.

The road should involve the following general considerations:

1st. It should be as short a route as the peculiarities of the country will admit.

2d. It should be as diffusive as possible in its advantages—a main artery of the great political body, admitting of branches in every direction.

3d. It should be a road for the whole year, and not a mere summer or seven months' road, with all its facilities closed for the winter.

4th. It should pass through a good soil—an inhabited or inhabitable country, possessing from climate and soil attractions to settlers, so that its advantages would be felt, and its cost be compensated in the enhanced value and occupation of adjacent lands.

5th. It should lead to our northern and eastern coast, and to our southern and eastern coast.

6th. It should take advantage, as far as practicable, of existing railroads.

These appear to me to be the general considerations, which, as far as practicable, should be fulfilled in such a road.

We will assume as the starting point on the Pacific the harbor of San Diego, because it is a frontier harbor and will have to be fortified; because it is the best harbor on our Pacific coast, that of San Francisco alone excepted, and because from this point the road is to be easily continued to any part of the coast, (through the valley of the Sacremento,*) and to be made an efficient element in the defence of that coast.

From San Diego, it will have to pursue, generally, Emory's trace of General Kearny's march, as exhibited in Emory's report.

From San Diego to the crossing of the Colorado will probably be about 200 miles by the railroad trace. At this vicinity there will no doubt be a very clever town, for, at this vicinity, the rail-

* This is the received designation of the valley formed by the Sacramento and San Joaquin.

road will have to open its fostering arms to the trade of the valley of the Colorado, and to the vast commercial resources of the bay of California, and of the southern coast of Mexico, which will, no doubt, prefer a port in this vicinity to the more exposed and more dangerous navigation of the Pacific coast of Lower California.

From the Colorado, the railroad will not be able to leave the valley of the Gila, but will pursue its course in that valley to its junction with the Rio del Norte, within our boundary on that river. On reaching this point, its facilities are opened to the whole valley of that river, by boating from below, by boating at seasons from above, or by a branch railroad to Santa Fé. There cannot be much choice in the route thus far, as in that distance it is essential for a military as well as commercial road.

From the Rio del Norte the road will have to pursue its course through Texas to the Mississippi. Various notions exist about the course of the road through Texas, and we are much in want of information on this part of the subject; but keeping in mind the general principles before indicated, and calling to aid the knowledge we have of that country, I am disposed to think that, after crossing the Rio del Norte, the road will have to tend somewhat southwardly, in order to turn the Guadaloupe range of mountains,* then passing through San Antonio, Basfrop, or La Grange, Washington, &c., to Nacogdoches.

By this route, the road will pass through a highly valuable part of Texas and communicate with the principal rivers of that State at boatable points, from which it will have access to the ports of this State on the gulf by means of these rivers, or by branch roads.

At Nacogdoches will probably be the best point for the two great branches—one leading to the northeastern coast of the United States, the other to the southeastern.†

The northern branch will probably find its better course to cross the Red river at the great bend or its vicinity, then crossing the Arkansas at Little Rock, pursue its most direct course to St. Louis; then crossing the river, to pursue the most direct favorable course which can be obtained south of the great lakes to Pittsburg.

From Pittsburg, its connexion north and east may be said to be already accomplished. At St. Louis, the road will open all its facilities to the upper Mississippi and to the Missouri and their tributaries.

From Nacogdoches the southern branch will probable take the most direct route to the Mississippi, distant about 175 miles, at a point near to and below the mouth of Red river. On arriving at this river, (the Mississippi,) the facilities of the road are open to the trade of that river at all seasons of the year, south to New Orleans and north to the Ohio. The crossing of this river should

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* It is said there is a very good route on the northern flank of the Guadaloupe mountains, in a course somewhat direct from the Rio del Norte, near our southern boundary on that river, to the head of steamboat navigation on the Red river of Louisiana, probably near old Fort Washita.

† It may probably be better to have this grand junction farther back in Texas, about Washington, and from thence conduct the southern route more directly to the Mississippi.

be by a ferry. A good steamboat ferry will be found to oppose no obstacles to the intercourse, and will admit of extension to any favorable point on the opposite side, up or down the river.

We will suppose for a moment this point to be Vicksburg: from Vicksburg to Washington by probable railroad trace is about 1,220 miles, of which 760 are already a made and used railroad; and this route has now in existence its communications with Savannah, Ga., Charleston, S. C., Wilmington, N. C., Norfolk or Norfolk harbor, at Portsmouth, Va., and other branch roads are in contemplation and being made, which will accomplish connexions with other harbors of the coast, and with Pensacola on the gulf.

Now, by either of these routes, the St. Louis route or the Vicksburg route, a traveller can go from Washington, the capital of the Union, to San Diego, on the Pacific, in less than seven days; that is, about six days and a half, at an average rate of twenty miles the hour.

All will be within our own territory—all will be under our own control. All the money expended in the construction of the road will be for the benefit of our citizens; and all those great accessory benefits of additional value to the soil, the creation of cities and towns, encouragements to emigration, &c., &c., will enure to the benefit of our own country and of our own citizens. In a word, all the advantages of such a communication, direct and indirect, will be our own.

The road from Washington to Vicksburg will, without doubt, be soon completed, by the same kind of company and State efforts, with which existing parts have been made.

The question, then, of interest, is the construction of the road from the Mississippi to the Pacific. At a meeting held in Boston, in reference to this road, in April last, it seemed to be a favorite scheme to have one grand charter for the road.

The right of the United States to grant a charter for such a purpose, within the limits of a State, would perhaps be questioned. But the right of the United States to aid the chartered companies of States for such purposes has the sanction of precedent in the United States subscription to the Louisville and Portland canal, the Delaware and Chesapeake canal, the Potomac and Ohio canal, and the Dismal Swamp canal; and in the exercise of this right, the subscription could be on prescribed conditions of dimensions and strength of road, and of privileges to transport the mail and munitions of war free of charge.

But the right of the United States to grant a charter for such a purpose from the Rio del Norte to the Pacific is, I believe, without question in reference to constitutional power, as within those limits there is no organized State government; and this charter could be granted on prescribed conditions and proportional aid.

Should the course of a charter be preferred, some plan like that just indicated could be pursued.

Or the United States could make the road from the Rio del Norte to the Pacific, under numerous legal precedents of constructing military roads within territories, and there need be no fears that

the connecting links from the Rio del Norte to Washington would be long delayed.

But the great question is the road. Any plan that is proper can be pursued in making it; and a great preliminary question is, the surveys in reference to the road. Upon this last, I believe there are no conflicting opinions in reference to the right of the United States to authorize the survey and to meet its expenses.

Most friendly and respectfully,

J. J. ABERT,
Colonel topographical engineers.

To FRANCIS MARKOE, Esq.,
State Department.

NATIONAL OBSERVATORY, *July* 2, 1849.

SIR: According to request and promise, I proceed to treat of the Panama railway, the commercial resources of the Gulf of Mexico, and the probable effects upon the prosperity of the country of a good commercial thoroughfare between the Atlantic and Pacific oceans.

The opening of a communication across the isthmus is one of the most important projects of the age. The country is ripe for it, and there are capitalists enough ready to embark in it, provided the government will hold out to them a fair and reasonable encouragement.

I see by the papers that books were opened the other day, in New York, for subscriptions to the Panama railroad, and that one million of dollars of the stock was taken. It is probable that this sum will be applied either to a light road for horse power, or to the construction of a track from Panama, 20 miles over to the river Chagres; neither of which plans will subserve effectually the great interests of the country or the purposes of commerce.

Before investing freely, or launching out boldly into such an undertaking, cool headed men desire to see the hand of their government with them in the work. They desire it not so much on account of the sum to be paid, but on account of the security, the confidence that it would give, to see the government assuming some sort of pecuniary responsibility with them in the matter.

As for the mere matter of dividends, capitalists could make more by first constructing the work on their own account, and then fixing their own terms for services rendered the government. But in this case there would be wanting the confidence in the work which a subscription to it by the government, or an offer of reasonable compensation for services to be rendered would impart.

If the government of the United States were to put its hand to the work, so that it should be soon in some tangible shape, either as a subscription or an annual instalment, the mere sight of it would give the world confidence in the undertaking, and this confidence would be worth far more in the eyes of business men than the mere dollars and cents out of the public treasury.

If the isthmus of Panama belonged to some strong and stable power, a railroad or ship canal there would present one of the most attractive fields for investment that could be presented to capitalists.

Let us take a view of this railroad, and our position with regard to it, in some of those manifold lights in which the wants of commerce and the great interests of the people of the United States present it. And for this purpose I extract from an article which I have recently written on the subject.

Rightly to do this, and properly to estimate the effects which are to arise from uniting the two oceans, it is necessary to pass in review the position in respect both to the old world and the new, of *our* Mediterranean, which consists of the Gulf of Mexico, with its archipelago, the Caribbean sea.

The geographical position of this sea and its shores, the size of the rivers which flow into it, the climates and soils of their valleys, and the hand with which nature has strewed the elements of commerce among them, all conspire to make it the most useful to the greatest number of men, and therefore the most interesting sea in the world. It is situated midway between the two Americas. Rivers whose head-waters reach back north and south into the very heart of the country, run into it.

A line from the delta of the Orinoco to the east end of Cuba is but a thousand miles long; and yet, to the west of it lies this magnificent basin of water, locked in by a continent that has on its shores the most fertile valleys of the earth. In the midst of these valleys ships may sail thousands of miles on the largest rivers that bring tribute to the ocean. They contain the elements of dormant wealth, of national power and greatness, which it requires facility of communication with the Pacific to begin to develope, and which, when fully developed, will astonish the world. An era and an epoch in the affairs of nations will date from the opening of this communication. All, and more too, that the Mediterranean is to Europe, Africa, and Asia, this sea is to America and the world.

A sea is important for commerce in proportion to the length of the rivers that empty into it, and to the extent and fertility of the river basins that are drained by it. The quantity and value of the staples that are brought down to market depend upon these. The Red sea is in a riverless district; few are the people, and small the towns along its coast. Its shores are without valleys; not a river empties into it, for there is no basin for it to drain. Commercially speaking, what are its staples in comparison with those of the Mediterranean, which gives outlet to rivers that drain and fertilize basins containing not less than one million and a quarter of square sea miles of fruitful lands?

Commercial cities have never existed on the shores of the Red sea. Commerce loves the sea, but it depends for life and health on the land. It derives its sustenance from the rivers, and the basins which they drain, and increases the opulence of nations in

proportion to the facilities of intercourse which these nations have with the outlets of such basins.

The river basins drained into the gulf and Caribbean sea greatly exceed in extent of area and capacity of production the river basins of the Mediterranean. The countries in Africa, Asia, and Europe, which comprise the river basins of the Mediterranean, are, in superficial extent, but little more than one-fourth the size of those which are drained by this sea in our midst. It is the Mediterranean of the new world; and nature has laid it out on a scale for commerce far more grand than its type in the old; that is, about 45 degrees of longitude in length, by an average of 7 degrees of latitude in breadth. Ours is broader, but not so long; it is therefore more compact; ships can sail to and fro across it in much less time, and gather its articles of commerce at much less cost.

The two seas cover each about the same superficial extent; but from one extreme to the other of that of the old world the route is tortuous and the voyage long; it cannot be accomplished without sailing a distance quite equal to that between Europe and America. Whereas, from the most remote point in the Caribbean sea to the farthest port in the gulf, a straight line may be drawn on the water, and the distance from one extremity to the other of it will be but little more than 2,000 miles.

From the ports of the Levant and Black sea to the ocean a vessel under canvass requires a month, or more; but from any point on the coast of this central sea of America a vessel may be out on the broad ocean in a few days. Winds and currents, with all the adjuvants of navigation, are here much more propitious to the mariner than they are in any other part of the world.

There is a system of perpetual currents running from the ocean into this sea, and from this sea back into the ocean. They are literally rivers in the sea, for they are as constant, and almost as well marked, as rivers on the land.

Had it been left to man to plan the form of a basin for commerce on a large scale—a basin for the waters of our rivers and the products of our lands—he could not have drawn the figure of one better adapted for it than that of the gulf, nor placed it in a position half so admirable.

The shores of the Mediterranean are indented by deep bays and projecting points of land, which greatly lengthen the sailing distance from port to port. The sinuosities of shore lines add to the expenses of commercial intercourse. By land, the distance from Genoa to Venice is that only of a few hours' travel; but by water, they are more than a thousand miles apart. There are no such interruptions to navigation in the Gulf of Mexico; the shortest distance from port to port there, as from New Orleans to the ports of Texas and Mexico, to Pensacola, Havana, and the like, is by water.

The windings of the Mediterranean shore line, exclusive of its islands, measure 12,000 miles in length; whereas, those of the gulf and Caribbean sea do not mete out half that distance.

Ships, therefore, which go into the Mediterranean have, to gather

the produce which is brought down from its river basins, containing less than two millions of square miles, to wind along a coast line 12,000 miles in length; whereas, those which go into the Gulf of Mexico may, by sailing 5,000 miles, reach the mouths of rivers that drain of water and surplus produce more than four millions of square miles of fruitful plains and fertile valleys.

Easy access by sea to the mouths of rivers which drain extensive basins of rich land has always been regarded as the best basis upon which the foundations of commerce can be laid. The character and extent of the back country which supplies such outlets are the true exponents of the commercial prosperity of the cities, and the condition of the people who dwell there. The closer these outlets are together, and the greater the diversity of the climates drained by them, the more numerous are their products, and the more active is their commerce. Hence the commercial importance of every bay, gulf and sea of the ocean may be considered as in direct relation to the extent, variety and fertility of their river basins.

Because the Red sea is in a riverless region, it has no markets; consequently it has, in the eye of commerce, ever been regarded as valueless in comparison to the bay of Bengal and the Mediterranean sea, with their broad basins and beautiful tributaries.

Every one, who takes the trouble to examine, is struck with the fact that the greatest commercial cities of the world are, and ever have been, those whose merchants have been most advantageously situated with regard to the outlets, natural or artificial, of great river basins and producing regions.

Rightly to perceive how admirably located and arranged for the purposes of commerce are the gulf and Caribbean sea, and duly to appreciate the advantages arising therefrom, let us, before comparing the river basins of America with those of Europe and Asia, or before tracing further the effects which the course of the rivers of a country has upon its commerce, take a glance at the geographical position of this our central sea.

Curtained on the east by a chain of fruitful islands stretching from Trinidad to Cuba, it is on the north and the south and the west, land-locked by the continent which has bent and twisted around this sea, so as to fold it within its bosom and hold it midway between the two semi-continents of the New World.

In this favored position it receives on one side the mountain streamlets of a sea of islands; on another, all the great rivers of North America; and on the others the inter-tropical drainage of the entire continent.

The Atlantic ocean circulates through this our Mediterranean. Its office in the economy of the world is most important. It not only affords an outlet for the great American rivers, but it makes their basins habitable by giving them drainage, and sending off far away into the ocean the drift and the overheated waters which the rivers bring down. It also, through its system of cold and warm currents, makes its own shores habitable to man, tempers the climate of Europe, and by its genial warmth makes productive the soil there.

The Amazon rising in the Andes and emptying into the ocean

under the line, also finds its way through the magnificent llanos and pampas of the tropics down to the margin of this sea.

In consequence of the gulf stream the mouth of the Mississippi is really in the Florida pass. The waters of the Amazon flow through the same channel. The great equatorial current of the Atlantic sweeps across the mouth of this river, and carries its waters into the Caribbean sea; from the Caribbean sea they flow into the Gulf of Mexico, and thence by the gulf stream back into the Atlantic. Such is the channel through which the waters of the Atlantic complete their circuit, and are borne back into the ocean again. The distance in a straight line from the mouth of the Amazon to the Florida pass is only twenty-four hundred miles. Therefore, the Amazon may very properly be regarded as one of the tributaries, and its basin as a part of the back country, to this our noble sea.

The connexion is even more close; for one mouth of the Amazon is that of the Orinoco, which empties directly into the Caribbean sea. These two streams present the anomaly of two great rivers having sources that are common. A person sailing up the Amazon may cross over into the Orinoco, and re-enter the sea through that river without having set his foot on shore or disembarked once. The Rio Negro takes its rise from the eastern slope of the Andes, and, after having run several hundred miles, it divides itself into two streams, one of which flows into the Amazon, the other into the Orinoco. This is nature's canal between them.

The Mississippi and the Amazon are the two great commercial arteries of the continent; they are fed by tributaries with navigable length of channel more than enough to encircle the globe.

This sea, therefore, is like a heart to the ocean. Its two divisions of sea and gulf perform the office of ventricles. Floating bodies from the region of Cape Horn, from the coast of Africa and the shores of Europe, are conveyed into the Gulf of Mexico, whence its waters, supplied anew with heat and motion, are again sent forth through their channels of circulation over the broad bosom of the Atlantic. To western Europe the heated currents of this sea distribute their warmth, and then return back to their sources through the invisible channels of the deep.

We have seen that the river basins of the Mediterranean cover but little more than one-fourth the area which is drained by the streams which empty into the central sea of America.

That we may realize the extent of these river basins of America, let us add to those of the Mediterranean the chief river basins of western Europe and southern Asia, and see then if they can outmeasure the valleys drained by our Mediterranean alone.

Before doing this, however, permit me to glance at the geographical features and physical condition which regulate the size of the river basins to be considered.

It is a remarkable feature in the formation of this continent that there are no great basins in the interior without sea drainage, and no rainless districts of any considerable extent. With one or two exceptions, as the inland basin of the city of Mexico, and the Salt

Lake, which comprise but small districts of country, all the water courses of America empty into the sea. The extent of country for sea drainage here is far greater than in any other part of the world. Hence we have larger valleys, valleys that are longer and broader than any in the old world. Consequently, they collect more water, call for more drainage, and hence give rise to more and larger rivers. In the old world there is a region of country 80° of longitude by 17° of latitude in extent, in which it never rains. Here, between the Andes and the Atlantic, there is no such rainless region. The annual fall of rain between the tropics in the old world is 6 feet; in the new world it is 11; and it is greater here than there, in the temperate zone also. More than one-half of all the fresh water in the world is on the continent of North America. In facts like these is found the explanation as to the cause of the surprising length and volume of many of the American rivers. Big rivers are required to drain broad valleys.

In Europe and Asia the great continental declivities are such as to leave no room for any remarkable length of river, or breadth of valley.

In North America, there is an immense valley between the Alleghany and the Rocky mountains. The great lakes form the northern edge of this valley, the entire drainage of which is therefore carried off towards the south into the Gulf of Mexico. This is the basin of the Mississippi.

In South America the Andes skirt the western coast very closely, and send off to the east a chain of mountains from Bolivia to the Atlantic coast of Brazil. These mountains divide South America into two great systems of river basins; the drainage of one is to the north and east, of the other to the south.

In the broadest part of the continent, therefore, which is its northern portion, the continental slope gives rise to the first mentioned system. The district of country included in it is an immense one, the rains are heavy, and the drainage great. Hence, the direction and volume of the Para, the Amazon, and Orinoco. The basin which slopes to the south is much less in extent; it is drained by the La Plata.

In one part of Europe the drainage is in all directions towards the Black sea, which is sunk down in a sort of basin of its own, and receives the drainage from several quarters. But the longest slope on the sides of this basin runs up west towards the centre of the continent. Here the Danube, and other draining streams, which empty into the Black sea, and thence into the Mediterranean, take their rise.

On the shores of this last, we have the drainage to the south, which gives rise to the Rhone, &c. Europe has its Atlantic slope also, and there the rivers, as the Tagus, the Rhine and the Elbe, run west. Thus you perceive that the geographical features of Europe leave no room for a hydrological expression like that of the Amazon and the Mississippi, with their valleys.

In the interior of Asia there is a grand continental basin 85 degrees of longitude in length. It is spread out over the middle of

the continent and extending from the borders of Europe to the eastern districts of China. It embraces a region of country more than 4,000,000 square geographical miles in extent, which has no ocean drainage. In the midst of the old world, it is surrounded by steppes and mountain ranges which shut it out from the world of waters beyond. It gives rise to many large rivers, as the Volga and the Omal; but they empty into the Caspian and other continental seas, which have no visible outlet or communication with the ocean. For all the great purposes of commerce, this immense and fertile basin is as blank as the desert of Zahara. Of course, then, the rivers above this basin must run north into the frozen ocean, which also is a blank as white as snow in the book where commerce records her statistics. These river basins embrace nearly four millions of geographical square miles.

On the south side of this inland basin the inclination of the continental level is towards the China seas and Indian ocean. Here, then, we must look for those river basins and the origin of those streams which give rise to the commerce of the east; and here, accordingly, we find the teeming valleys drained by the Euphrates, the Ganges, and the Yangtse Kiang; all of which descend from fruitful plains, and all except the last are open to trade and traffic with "outside barbarians."

The distance from the bay of Bengal and Arabian sea to the southern edge of this great inland basin varies from 3 to 10 degrees of latitude; consequently the climate, through which the rivers of India flow, is limited to 10 degrees of latitude; the produce that comes down those streams for market has no greater range of climate than that which is due a north and south line of five or six hundred miles in length. Neither can the rivers themselves be very long, nor their basins very broad, nor their volume of water very great. Their valleys may vie in fertility with those of the Mississippi and the Amazon; but as for diversity of climate, variety of productions, and navigable capacity of water courses, there is no comparison.

Let us now return to the comparison as to extent of the river basins of the old world, with those under consideration in the new.

According to one of the most remarkable works of the age—Professor Johnson's Physical Atlas—the river basins in the old world contain, in geographical square miles, stated in round numbers, as follows, viz:

Of Mediterranean, Europe	1,160,000	sq. m.
Nile	520,000	"
Euphrates	196,000	"
Indus	312,000	"
Ganges	432,000	"
Irawady	331,000	"
Others of India	173,000	"
Those of western Europe, as Rhine, &c	730,000	"
Total Mediterranean, India, and west. Europe	3,854,000	"

Area in geographical square miles of river basins drained into the Gulf of Mexico and Caribbean sea.

Basin of Mississippi river	982,000	sq. m.
Basins in Florida and Texas (estimated)	520,000	"
do Mexico and Central America (estimated)	300,000	"
do Amazon	1,796,000*	"
do Orinoco, and all others of Caribbean sea	700,000	"
Total gulf and Caribbean sea	4,298,000	"
Do Mediterranean, India, and west. Europe	3,854,000	"

Difference—call it nothing, though it measures an area containing nearly half a million of square miles.

From this statement we are led to the very remarkable conclusion—and it is an important physico-commercial fact—that the area of all the valleys which are drained by the rivers of Europe which empty into the Atlantic, of all the valleys that are drained by the rivers of Asia which empty into the Indian ocean, and of all the valleys that are drained by the rivers of Africa and Europe which empty into the Mediterranean, does not cover an extent of territory as great as that included in the valleys drained by the American rivers alone, which discharge themselves into our central sea. Never was there such a concentration, upon any sea, of commercial resources. Never was there a sea known with such a back country tributary to it.

The produce which comes down the rivers of Europe has, when it arrives on the shores of the Atlantic, to be transported 15,000 or 20,000 miles to be exchanged for that which comes from the river basins of India. From the mouth of the European rivers discharging into the Atlantic ocean, the voyage to the mouth of the Asiatic rivers which run into the Indian ocean, often occupies 200 days; consequently, it requires a ship more than a year to take on board a cargo from the river basins of Europe, go with it to India, exchange it, and return with the proceeds thereof to the place whence she started; so great the distance, and so long the period of time which separate these two fountains of commerce.

One ship, therefore, trading between the American system of river basins may fetch and carry, exchange and bring back in the course of one year as many cargoes as ten ships can, in the same time, convey between the remote basins of the system in the old world.

The products of the basin of the Mississippi, when they arrive at the Balize may, in 20 or 30 days, be landed on the banks of the Orinoco and Amazon. Thus, in our favored position here in the new world, we have, at the distance of only a few days' sail, an extent of fruitful basins for commercial intercourse which they of the old world have to compass sea and land, and to sail the world around to reach.

* Including basin of Para.

On this continent, nature has been prodigal of her bounties. Here, upon this central sea, she has, with a lavish hand, grouped and arranged in juxtaposition all those physical circumstances which make nations truly great.

Here she has laid the foundations for a commerce the most magnificent the world ever saw. Here she has brought within the distance of a few days the mouths of her two greatest rivers. Here she has placed in close proximity the natural outlets of her grandest river basins. With unheard of powers of productions, these valleys range through all the producing latitudes of the earth. They embrace every agricultural climate under the sun; they are capable of all variety of productions, which the whole world besides can afford. On their green bosom rests the throne of the vegetable kingdom. Here commerce, too, in time to come, will hold its court.

The Mississippi comes down from the grain producing regions of the north, bearing vessels deeply laden with produce; freighted with all varieties of the fruits of the temperate zones, they convey to the sea large cargoes of merchandise, gathered from the products of the field, the forest, and the mine. Hills of iron, mountains and valleys filled with coal, are found on its banks. Its waters are mingled in the gulf with those of the Amazon and Orinoco, which run between the tropics. From their basins, they are ready at the bidding of civilized man to place on this sea, in all variety and abundance, the products of the torrid zone.

Arrived in the gulf with these goods, the mariner then finds a river in the sea to speed him on with its favoring currents to prosperous voyages. Through the gulf stream the productions of this grand system of river basins will be distributed over the world, passing by, and enriching as they go, Norfolk, Philadelphia, New York, and Boston, all the Atlantic slope of the United States, and all the Pacific slope too.

From fifty degrees north to twenty degrees south the Mississippi and the Amazon take their rise. A straight line from the head waters of one to those of the other, measures a quadrant of the globe. They afford outlets to all the producing climates of the earth. Upon this gulf and sea perpetual summer reigns; and upon their shores climate is piled upon climate, production upon production, in such luxuriance and profusion, that man, without changing his latitude, may, in one day, ascend from summer's heat to winter's cold, gathering as he goes the fruits of every clime—the staples of every country.

To gather such things in the old world, commerce must first plume her wings and sail in search of them through all latitudes and climates, from the extreme north to the farthest south.

In the small compass of the West India sea are crowded together the natural outlets of the ocean, from mountains, plains, and valleys, that embrace every variety of production, every degree of latitude and climate, from perpetual winter to eternal spring.

The largest water courses of Europe and India do not run through more than ten or fifteen degrees of latitude. The greatest variety

of climate possessed by the river basins of India, the Mediterranean and Atlantic Europe, is included between ten and fifty-five degrees of north latitude; only forty-five degrees of latitude there against seventy degrees here. There they are all in the same hemisphere, and when it is seed time in one basin, it is seed time in all; and a short harvest there produces famine. Here, in the American system, we include both hemispheres, and therefore when it is seed time in one basin, it is harvest in the other. With this blessed alternation of seasons, so near at hand, and so convenient to our great seaport towns and avenues of trade, famine on these shores is impossible. With this American sea between the two hemispheres, and in the lap of both, nature has endowed it with commercial resources and privileges of infinite variety.

Here come together and unite in one the natural highways to the ocean, from mountains, plains, and valleys, teeming with treasures from the mineral, the vegetable and the animal kingdoms—nature's most princely gifts to man.

Were it given to us of this day to look down through future generations, and to see the time when the valleys of the Mississippi, the Orinoco and the Amazon shall be reclaimed, peopled and cultivated up to their capacities of production, we should behold in this system of river basins, and upon this central sea of ours, a picture such as no limner can draw—no fancy can sketch. All the elements of human greatness, which river, land and sea can afford, are here crowded together; for their full development, easy access to the Pacific is necessary.

The course of a river exercises important bearings upon commerce. A river that runs east or west has no diversity of climate; its basin is between two parallels of latitude, and there is no variety of production from source to mouth, except such as is due to elevation. The husbandman who inhabits the banks of such a stream, when he descends it with his surplus produce for exchange and barter, finds on his arrival at its mouth that he has but come to Newcastle with coals only. He is there offered duplicates in exchange for what he has brought to sell; all sellers and no buyers never can make commerce brisk. Such a river may have a staple: it may be corn, it may be oil; but whatever it be, it is all they who dwell in its valley have to sell; and whatever they buy, they buy with that staple. The commerce of such a basin, therefore, must be with other latitudes, with other climates, and with regions which afford *variety*.

On the contrary, one who descends a river that runs north and south, finds his climate changing day by day—at every turn new plants and strange animals meet his eye. He brings with him from its head waters the furs, the cereal grains, and a variety of articles, (productions of the north,) to exchange for the coffee and sugar and the sweets of the south, which are gathered on its banks below.

It is the business of commerce to minister to the fancies as well as the necessities of man; she therefore delights in variety of climate and assortments of merchandise. It is owing to the diversity of climate and production afforded by the States of this Union, and

to the facilities of intercourse with them, that the trade of a single State, as Massachusetts, with the rest, exceeds in value the entire foreign commerce of the whole country with all the world besides. The pursuits of commerce abound in secrets of high import to the happiness of man; an easy communication from the gulf to the Pacific is the key to some of them.

"As the external face of continents," says Humboldt, "in the varied and deeply indented outline of their coasts, exercises a beneficial influence on climate, trade, and the progress of civilization, so also in the interior, its variations of form in the vertical direction, by mountains, hills and valleys, and elevated plains, have consequences no less important. Whatever causes diversity of form or feature on the surface of our planet mountains, great lakes, grassy steeps, and even deserts surrounded by a coast line margin of forest, impresses some peculiar mark or character on the social state of its inhabitants."

Our lofty mountain chains and majestic water courses have served, according to the same great philosopher, to furnish a more beautiful and rich variety of individual forms, and to rescue the face of the continent from that dreary uniformity which tends so much to impoverish both the physical and intellectual powers of man.

Had the Missouri river, after taking its rise under the Rocky mountains, and uniting with the Mississippi, held its course eastward until their waters were emptied into Long Island sound, how different would have been the present condition of these United States; had the drainage of the country been in this direction, the Gulf of Mexico would have been as a stagnant pool, and we should have been as indifferent to New Orleans and the purchase of Louisiana, as we now are to Merida and Yucatan. Because the Mississippi river runs from the north to the south, it is one among the strongest of the bonds which hold this union of States together.

All the great rivers of the United States lie wholly within the temperate zone. Their basins are spread out under climates which call for the highest energies of man. Dwelling in such regions, he is constrained to be diligent; to labor; to be prudent; to gather into barns; to study the great book of nature; to observe her laws; and, whilst it is summer, to take thought for the winter.

The perpetual summer of the tropics presents no such alternatives. On the same tree may be seen the bud, the flower, and the ripe fruit. Here, therefore, nature urges no such necessities, imposes no such tasks, and savage man is as careless of the morrow as are the lilies of the field. The people of the two climates are, therefore, different. Frequent intercourse between them will improve the character of each, and the most ready channels for such communication are afforded by the rivers that run north or south. With the exception of the Nile, the general direction of all the rivers of Africa is east or west; and not one of their valleys, except the valley of the Nile, has ever been the abode of civilized man.

Civilized society cannot be stationary. Vacuity is not more ab-

horrent to nature than is a state of rest, either in the moral or the physical world. The materials of the latter she has divided into ponderables and imponderables, and invested them with antagonistic principles By the action of light, heat and electricity upon ponderable matter, "the morning stars were first made to sing together," the earth is clothed with verdure, the waves lift up their voice, and the round world is made to rejoice.

She has divided the former into animal and spiritual, and they are antagonistics—the one elevating, the other depressing man in the scale of being. When his course ceases to be upward and onward, the spirit yields to the animal; virtue gives way to vice; the force of evil prevails; and the course of men in their social state is no longer onward and upward, but backward and downward. The sphere that lags behind in its course is hurled from its orbit. History bears witness to the fact that when nations cease to rise, they begin to fall. The laws of nature are her agents; they cannot act and be still; action implies motion; nature herself is all life and activity; she knows no rest; brooks no pause, either for her moral or her physical agents. Wise men say that she has attached a curse to standing still. This is German philosophy; but the idea is beautiful because it is true. We want the stimulants to energy, the incentives to enterprise, which a highway across the isthmus is to give, to urge men to the high destinies which await us. The energies of the country are great; they require highways to the Pacific to give them scope and play.

On account of this central sea, and its system of winds and currents; on account of the course of the rivers which run into it, and of the direction of mountain ranges that traverse the continent; and on account of the character and extent of the river basins and other geographical features with us, the old world affords no parallel, either in history or example, by which to judge of the destinies of this country. Our mountain ranges are longer, our rivers are more majestic, our valleys are broader, our climates are more varied, our productions are more diversified here than they are there.

The wheat harvest on the lower Mississippi commences in June; and in the upper country, Christmas is at hand before the corn crop is all gathered in. Thus we have, in the valley of this majestic water course, a continued succession of harvests during more than half the year. In the other hemisphere the seasons are reversed; and on the banks of the southern tributaries to our central sea, reapers are in the field during the remainder of the year. A sea which is the natural outlet to market of the fruits of regions where seasons are reversed, and the harvest is perennial, is no where else to be found.

Such advantages, both moral and physical—such means of power, wealth and greatness as have been vouchsafed to us, no nation has ever been permitted to enjoy. We have already more works of internal improvement, a greater length of railroad and canal, built and building, and of river courses open to navigation—more of the buds and blossoms of true greatness, than all the world besides.

In these facts we see the effect of geographical features as well as of free institutions.

As a general rule, our railroads and rivers are at right angles in their courses. In the New England States, where the rivers run south, the railroads run east and west; in the middle and southern States, where the water courses run eastwardly, the railroads take a more northwardly direction. Rivers run from the mountains to sea; railroads run across the mountains. They go from valley to valley.

In calculating the sources of the national wealth, prosperity and greatness, which are contained for this country in river basins, central sea, mountain ranges, water courses, and geographical features, the lights of history are of no avail. You may prepare the canvass and make ready the easel, but colors that are bright enough for the features cannot be found. The exceeding great resources of our Mediterranean beggars description.

We know that other places, with the elements of commerce in far more scanty proportions, with facilities less abundant and obstacles far greater, have grown opulent and obtained renown in the world. While one calls to mind the history of such paces, he feels that here is room and scope enough for individual wealth far more dazzling, for national greatness far more imposing, and a renown far more glorious.

From all this, one is led to the conclusion that the time is rapidly approaching, if it have not already arrived, when the Atlantic and Pacific must join hands across the isthmus. I have shown that there is no sea in the world which is possessed of so much importance as this southern sea of ours; that with its succession of harvests there is, from some one or other of its river basins, a crop always on the way to market; that it has for back country a continent at the north and another at the south, and a world both to the east and the west. I have shown how it is contiguous to the two first, and convenient to them all. The three great outlets of commerce—the delta of the Mississippi, the mouth of the Hudson and the Amazon—are all within 2,000 miles, ten days' sail, of Darien. It is a barrier that separates us from six hundred millions of people—three-fourths of the population of the earth. Break it down, therefore, and this country is placed midway between Europe and Asia; this sea becomes the centre of the world, and the focus of the world's commerce. Open this as a highway, and you will give vent to commerce, scope to energy, and range to enterprise, which, in a few years hence, will make gay with steam and canvass parts of the ocean that are now unfrequented and almost unknown. Old channels of trade will be broken up and new ones opened. I greatly desire to see our own country the standard bearer in this great work.

The railroad across the isthmus of Panama will speedily lead to the construction of a ship canal between the two oceans, for a railroad cannot do the business which commerce will require for it; and by showing to the world how immense this business is, men will come from the four quarters to urge with purse and tongue the construction of a ship canal.

The two shores of the Atlantic have been brought nearer together by means quite different from those proposed for uniting those of the Atlantic and Pacific oceans. In both cases, there is a saving of time with increased facilities of commerce. The Atlantic has been narrowed, so as practically to bring America within two weeks of Europe, instead of having them as many months apart as they formerly were. Whether this has been done by railroad or canal, or by the improvements of the age and the enterprise of man, the effect, so far as the saving of time and the advantages to intercourse resulting therefrom, is the same.

Now, let me call to your mind the benefits that our people and the world have derived in consequence of bringing the two shores of the Atlantic closer together, that you may the better judge as to the effects of the proposed connection with the Pacific.

Rightly to appreciate these benefits, which it required ages to bestow, it is necessary to contrast our present condition with what it would have been under the old state of things, when "coward commerce" crept along the frightful shores, and scarce had nerve or strength of wing to venture out upon the blue water; when ships were tubs at sea, that found it as much as they could do to average fifty miles a day, even under a press of canvass; and when, for the want of roads and canals, the fruits of the earth could only with great difficulty and expense be conveyed to market. Less than 200 years ago, the roads in England were so bad, the difficulties of communication so great, that entire crops were sometimes suffered to rot in one place, while in another place, distant only a few miles, the supply fell far short of the demand.* No marvel, then, that plagues, pestilence, and famine, were common in those days, and that great nations were eager to have access by sea to the mouths of large rivers; for navigable rivers were, and still are, the most ready channels for conveying the surplus produce of their basins to market. What would the commerce of the country now be worth? what would its maritime consequence, its wealth, its power, its greatness now be, in comparison to what they are, had the passage of the Atlantic been as tedious, the difficulties in navigating it as great, and the obstacles in the way of trade and commerce as formidable now, both by land and water, as they were a century back? The very causes which have contributed to remove them and to shorten the passage across the Atlantic, are so important, by reason of their effects upon the condition of men and nations, that the great Humboldt, in his admirable cosmos, considers them as constituting an epoch in the history of the *universe*.

According to him, the discoveries and improvements of navigation, the use of the compass, the variation of the needle, the log, chronometers, the means of determining the place of the ship at sea, improvements in ship building, the introduction of steam in ocean navigation, and the like, ought all to be regarded as exerting a favorable influence in bringing within the reach of civilization and the christian religion, all parts of the earth's surface, and

* Macauley's History of England.

in shaping the fortunes of men—the destiny of nations. These causes have been ages in producing their effects, and the epoch is spread over centuries; the obstacles which ignorance and prejudice, the trammels which unwise laws and blighting monopolies place in the way of commerce, had all to be removed before the passage of the Atlantic could be narrowed down to its present limits. But here the means are different; a continent is to be cut in twain, and the four quarters of the globe are to be brought in closer proximity per saltum. The task is easier. The people are ripe for it; the husbandman, who supplies commerce with her staples, is enlightened and free; mechanics are all-powerful with their achievements; the principles of free trade have gained strength; the blossoms of civilization, sheltered by wise laws and free institutions, have unfolded themselves vigorously: everything but congressional action conspires to make the work easy.

Progression and improvement are the order of the day. Instead of throwing obstacles in the way of commerce, the spirit of the age demands for it every facility that is calculated to promote friendly contact and free intercourse among nations. Great revolutions in trade are to follow the separation of the two parts of the continent, whether by railroad or ship canal. Let us consider some of the most obvious results, but by no means, therefore, the most important that are to arise from it. At present the whale fishery is the most important branch of business which the citizens of the United States carry on over the waters of the Pacific. The floating capital annually employed in it does not fall much short of fifteen millions of dollars.

It so happens that we have cruised over the Pacific for a number of years, that we have seen much of the whalers, and enjoyed rare opportunities of obtaining statistics and other information touching this interest. Here is some of it:

According to the Whalemen's Shipping List of January 9, 1849, published at New Bedford, there are, at this time, out upon the high seas a whaling fleet of 613 sail, carrying, in round numbers, 200,000 tons. We subjoin a comparative statement drawn from the same authority, as to the quantity of bone and oil, (sperm and right,) imported for the last nine years:

	Bbls. sperm.	Bbls. whale.	Lbs. bone.
Imports for 1848.....	107,976	208,856	2,008,000
" 1847.....	120,753	313,150	3,341,680
" 1846.....	95,217	207,493	2,276,939
" 1845.....	157,917	272,730	3,167,142
" 1844	139,594	262,047	2,532,445
" 1843.....	166,985	206,727	2,000,000
" 1842.....	165,637	161,041	1,600,000
" 1841.....	159,204	297,348	2,000,000
" 1840.....	157,791	207,908	2,000,000
Total for nine years...	1,271,171	2,047,300	20,926,206
Average for nine years	141,242	235,456	2,324,578

The present value of sperm oil is $1 40 per gallon, but usually about $1, equal to $32 per barrel. The value of whale $10 50 per barrel; and of bone, 33 cents per lb.—equal to $4,519,744 for the average of sperm, $2,472,288 for whale, and $367,110 for bone. Total, $7,356,142 annually fished up out of the sea. This is a sum far greater than that which is annually gathered for commerce out of all our magnificent forests.

We are not able to state the precise number of vessels employed in the Pacific, or how much of this seven millions and a third should be credited to that ocean, though in 1846 there were 292 vessels fishing on the northwest coast alone; and they took while there 253,500 barrels of oil. We may safely assume that two-thirds of the whole number of vessels engaged are employed in the Pacific; and that three-fourths of the oil taken comes thence, for the vessels in the Pacific are larger than those in the Atlantic fishery. This would give for the Pacific, in round numbers, 400 vessels, yielding annually five millions and a half of money.

The cost of outfit and vessels for this fleet is about $28,000 per vessel; the average length of a voyage (mean of right and sperm whalers) is three years; of which one third is lost in going and returning from the whaling grounds, laying in port to re-cooper, refresh, &c., leaving but two years of actual fishing, or eight months in twelve.

The rate of insurance upon vessels and outfits is 3 per cent. per annum, and the legal interest upon the money invested in ships and outfits, which make no return until the end of the voyage, is 6 per cent.

The loss of oil by leakage is five per cent. during the voyage.

Now, Panama is on the confines of one of the most valuable whaling grounds in the Pacific. In that vicinity, and near the Gallapagos islands, the sperm whale resorts in large numbers; and if a railroad or ship canal were constructed across that isthmus, it would vastly benefit this interest, in which there is a floating capital greater than that employed in all our commerce with China and the ports and countries bordering on the Pacific and Indian oceans put together.

If this oil, then, instead of remaining on board the vessel from one to two years (for that which is taken the first year remains on board two years, and that which is taken the second, one year) as dead capital, could be sent home across the isthmus at reasonable tolls, the gains would be great, for there would be a saving of both time and substance; the leakage would amount to but 1 per cent. instead of 5; half the time, at least, that is now employed in consequence of having to desert the whales to cooper the oil, refit and refresh, would be saved; the whaling year might be made to consist of 10 instead of 8 months, with of course a proportional increase of profits on the original outlay for additional two months of fishing; the vessels employed in the business, instead of being large ships, capable of holding 2,800 barrels—the proceeds of three years—would be small ships, capable of holding only one year's gathering; and the cost of smaller vessels, say one-third the

size of those now employed, instead of running up to $28,000 each for vessel and outfit, would, by a liberal estimate, be brought down within half that sum.

Estimating the charge per ton for storage, freight, and handling at the enormous rate of $20, or $2 per barrel across the isthmus, (this is 20 cents per ton per mile over railroad,) and the freight thence to the United States to be $1 per barrel, or $10 per ton, the following comparative statement is obtained, in illustration of the importance to this interest alone of such a communication:

Cost, outfits, and expenses of vessels on a three years' whaling voyage in the Pacific ocean.

Cost of 400 vessels of 2,800 barrels, at $28,000	$11,200,000
Six per cent. interest on same for 1 year	672,000
Three " insurance " "	336,000
Ten " wear and tear on costs and outfits	1,120,000
Two years' interest on $1,833,333, being one-third of the value of oil taken during three years, of which one-third is kept on board ship, dead capital for two years	220,000
One year's interest on the oil taken second year	110,000
Leakage, being 4 per cent. on $5,500,000	220,000
Annual average disbursement per ship, $2,000	800,000
Original outlay and expenses for one year's whaling in the Pacific	14,678,000

Credits and receipts.

Value of vessels and outfits after 1 year's wear and tear	$10,080,000	
Value of cargoes returned	5,500,000	15,580,000
Gross profits		902,000

Per contra: supposing a communication across the isthmus, and the whaling business to be revolutionized by the substitution of vessels of one-third the present size, and half the cost, and by sending the oil home once a year:

Cost of 400 vessels of 933 tons, at $14,000	$5,600,000
Six per cent. interest on same for one year	336,000
Three " insurance	168,000
Ten " wear and tear	560,000
Annual disbursement per ship, $1,000	400,000
Loss by leakage 1 per cent. on $6,875,000	68,750
Freight, &c., over railroad, of 48,240 tons at $20 per ton	970,800
Freight thence home, at $10 per ton	485,400
Original outlay and expenses of whaling one year, and sending proceeds home by Panama railroad	8,588,950

Credits and receipts.

Value of vessels and outfits, deducting one year's wear and tear.....	$5,040,000	
Value of bone and oil collected by fishing 10 months instead of 8 months..	6,875,000	—11,915,000
Gross profits via railroad		3,326,050
" " around Cape Horn		902,000
Margin in favor of the Panama railroad, on account of the whaling business		2,424,050

Two millions and a half is a large margin; but there is room for a larger margin. Whether the national wealth would be increased to the full extent of it or not, it is evident from the exhibit that the communication in reference to this one interest alone is of sufficient national importance and magnitude to command the most attentive consideration. The prospect of gain is, to say the least, inviting.

It has been the policy and practice of the United States, acknowledged at an early day, and carried out for many years, to encourage nurseries for seamen; with this view, bounties are given to the cod and mackerel fishermen, and the sum paid them from first to last as "fishing bounties," would be quite sufficient to lay double tracks of railroad across the isthmus. The whale fishery is by far a more valuable nursery than those of the grand banks of Newfoundland for seamen, and it has never received any bounties or direct encouragement whatever. It has been left very much to itself. You recollect the fact, and I mention it in this communication with some feelings of pride, that "Old Ironsides" and the "United States," in the last war, were both manned and fought principally by Marblehead men; New England whalemen they were.

Other great interests of state, no less than this, require such legislation as the constitution allows, and is necessary to insure the early completion of this road.

Mexico is protecting the manufacture of coarse cottons, known as *tucuyas*, and is seeking by this means to make Guadalajara her Lowell. Formerly, the raw material from this country was sent around Cape Horn. Cotton is indigenous to Peru. There it bowls and opens all the year, and our merchants have discovered that by encouraging the Peruvians in the cultivation of this staple, it is their interest to send other cargoes in their ships around Cape Horn, exchange them for the cotton of Payta and Lambayeque, and take that to Guadalajara. During the last year, ten thousand bales were taken from these two ports by American ships alone to Mexico.

This is quite as great as the exports of cotton from the United States were fifty years ago, and the demand is on the increase. It is dangerous to foster in a foreign country any rivalry, however humble in the beginning, to great national staples.

The freight on cotton around Cape Horn is $25 the ton; with this Panama railroad, it would be from New Orleans less than one-third that sum.

Costa Rica, on the Pacific, produces sugar and the finest of coffee. They are exported to Chili and Peru. The voyage around Cape Horn, and other conditions of commerce, exclude them from our markets. A railroad across the isthmus would bring New Orleans within two weeks of these coffee and sugar plantations; thus it would bring a new market into competition with the coffee of Brazil and the sugar of the West Indies.

I have investigated the subject of freights around Cape Horn, and have collected statistics that I might form an opinion as to the probable cost of the transportation of merchandise via Panama railway, and via "the Horn," to the ports of the Pacific—say to Lima, in Peru. I have supposed the freight over the Panama road will be at least double the usual rates in this country, and have taken it as at ten cents per ton per mile. The conclusion is, that a cargo of merchandise can be sent from New York, via Panama, to Lima in one-fourth the time, and for less than half the money, that it now takes to send it around Cape Horn.

Here are the facts, the statistics and estimates from which this conclusion is drawn. The sailing distance from New York to Lima, via Cape Horn, is 13,000 sea miles—the time, four months; the freight, fifteen dollars, or one mill and fifteen-hundredths of a mill per ton per mile.

The distance, via Panama, exclusive of the 45 miles of railroad, is 3,700* miles, and the time 30 days.

The average value of a ton of merchandise is supposed to be $250, on which three months' interest is charged for the excess of the Cape Horn passage.

Comparative statement as to the cost of freight per ton from New York to Lima:

Via Cape Horn, 13,000 miles, at 1.15 mill		$15 00
Interest on $250 for 3 months, 6 per cent		3 75
		$18 75
Via Panama, 3,700 miles	$4 25	
Forty five miles railroad, at 10 cents	4 50	
		$8 75
Difference in favor of railroad		$10 00

There are eight millions of people inhabiting the Pacific coast; all of them want things that we have to sell. They are four or five months removed from us; this road would bring them within thirty days.

For those of them who travel, the route to California and China would be across the isthmus this way to New Orleans, thence up

* 3,700, which is less than the distance by canvass from Charleston to Liverpool.

the Mississippi to the California railroad. This, when opened, will be their shortest and best travelling route to California, China and India. And unless both the California and Panama routes be established, the line of travel between the Pacific shores of North and South America never can be brought through the United States. These two roads are links on the same line, and when once completed the world cannot prevent all the South American travel from coming this way.

We see cities and States pushing forward rival schemes of internal improvements, and setting up opposition after opposition to bring travel their way; they consider themselves rewarded when they secure the business between places containing a few thousand people engaged in traffic. This Panama improvement would bring us the travel from countries inhabited by millions, and send it through the length and breadth of the land, dispensing national, sectional and particular benefits all the way. The advantages that business and travel scatter on the way side of their great thoroughfares are and ever have been objects of desire with the greatest nations, as well as with the smallest corporations. Here they are offered to us on a scale grand in proportion to the water courses, mountain ranges, lakes and river basins of the new world, and sublime in proportion to its free institutions. The railroad will build a ship canal across the isthmus of Panama, upon the same principle that one internal improvement begets another. How many railroads has the Erie canal caused to be built, that but for that improvement would not be in existence? In the same way, the Panama railroad will stimulate commerce with the Pacific, and by showing the amount of business to be done, men of business will see and be satisfied that the road is insufficient, and a ship canal necessary.

Owing to the course of winds, the direction of currents, and other physical circumstances, British merchants are ten days' sail and upwards nearer than we are to all the markets of the world, except those of the Caribbean sea and Gulf of Mexico. They are next door to all the markets of Europe; to Brazil, to Cape Horn, the Cape of Good Hope; and, consequently, to all ports beyond them, they are practically some ten or fifteen days' sail nearer than we are. A vessel from the United States bound to the southern hemisphere first sails nearly an east course until she arrives in the vicinity of the Azores and Canary islands; she then puts her head south for the first time. Now, while the American vessel is sailing this route, the English vessel that sailed on the same day for the same market has passed those islands and is far on her way. For the reason that the Cape de Verde islands are some ten or fifteen days nearer to England than to America, England is that much nearer to the southern hemisphere; for vessels generally, whether from the United States or from England, are in the habit of passing by these islands on their way thither.

Therefore, the Englishman meets the American in all the markets of the world, except those of the gulf and Caribbean sea, with the advantage of ten days and upwards.

Notwithstanding this disadvantage, the United States, in their commercial race with England, have, for the last fifty years, been gradually gaining. They have been coming up all the time, and at last the contest has become so close that England is hardly a throat-latch ahead. Cut through this isthmus, "Uncle Sam" will then turn the corner, and England will be distanced. Instead, then, of meeting us in India, China, and even on our own Pacific coast, with the advantage of some ten days' sail or more, the scales will be turned, and we shall have the advantage of some twenty or thirty days, thus making a difference in our favor of thirty or forty days under canvass.

Do you doubt, can any one doubt, as to the effect of a communication which would produce such a change as this in the commercial position of the two countries?

In this point of view alone, a communication across the isthmus is a subject of great national importance, for it would place the Atlantic and gulf ports of the United States right on the way side of the great commercial thoroughfare to India and China, and all the markets of the Pacific.

Respectfully, &c.,

W. F. MAURY.

Hon. John A. Rockwell, *M. C.*

Communication of John L. Stephens, esquire, with a preliminary report of Colonel George W. Hughes, in relation to a railroad across the Isthmus of Panama.

Office of Panama Railroad Company,
July 10, 1849.

My dear Rockwell: When you called upon me for such information as I possessed on the subject of the isthmus of Panama, that information might have been of some value. It consisted of the results of a preliminary survey, begun at high water mark on the shores of the Pacific, and carried across the cordillera down to the first stream that empties into the Atlantic. But these results have become unimportant in consequence of the full exploration and survey made during the last winter by a large corps of engineers under the direction of Colonel George W. Hughes, of the United States topographical department.

I have the satisfaction of handing you herewith a report, hastily prepared by Colonel Hughes on his return voyage to this city, which I hope will be in time for your purposes.

Respectfully and very truly your friend,

JOHN L. STEPHENS.

Hon. John A. Rockwell, *Norwich.*

STEAMSHIP CRESCENT CITY,
At sea, June 10, 1849.

GENTLEMEN: In compliance with your instructions of the 23d May, I have the honor of submitting the following (necessarily brief and imperfect) preliminary report of the survey and location of a railroad across the isthmus of Panama. You will readily understand the difficulty under which I labor in preparing anything like a professional paper before all the results obtained by our surveys have been digested and collated. But sufficient information has been collected to enable me to give reliable opinions in general terms as to the probable cost of construction and ultimate utility.

The organization for the work of the survey was made by dividing the whole force into four parties, amongst which the work of examination of the whole line (about fifty miles in extent) was distributed. The duties were those of exploration and approximate location; the *general* reconnoissance of this part of the isthmus (by means of which the region of country necessary to be surveyed was determined) being made by myself, aided by all the lights which I could obtain from the labors of others; and the result of those observations is to satisfy me perfectly that, with the exception of slight and unimportant changes, we have actually traced the most favorable line that can be found for uniting the oceans between Lake Nicaragua and the Gulf of Darien, crossing probably the lowest depression of the continent at the place of its least width; and I feel confident in expressing the opinion that the route which we have selected can be proven to possess advantages of the highest order over any other projected line calculated to effect the same great object.

The labors of the survey, organized as above stated, were continued from about the 10th of February to the 25th of May, 1849, and as the weather was generally good, and the work pursued energetically, I feel enabled to state that my data are sufficient to enable me hereafter to present a detailed, and it is hoped, a satisfactory report.

The general course of the line is as follows: Beginning at a point on Limon bay, on the Atlantic coast, about six miles east of Chagres, where good anchorage and protection and harbor room are found; running thence southerly towards the valley of the Chagres, into which we penetrate without heavy cutting or other serious obstacle; thence continuing up the valley of the Chagres, without crossing the river, until within about a mile of Gorgona; there, at a favorable point, crossing the river and continuing up the valley to Gorgona; at which place the line leaves the immediate valley, but continues within the limits of its drainage, pursuing the same general course as below, crosses the country towards the dividing ridge of the continent, which is reached in a distance of about nine a half miles from Gorgona, and with a height of less than 300 feet above the Pacific; thence descending towards

the Pacific, where it terminates near Panama, with a distance from the summit of about 10 miles.

The surface of the country over which the summit portion of the line passes is hilly and much broken; but this very feature enables us to select ground far more favorable in its topography than is occupied by many of the most important railroads of the United States; hence there are but few points where we encounter heavy work, and the alternation of cutting and filling is quite favorable. The general features of the line, and the principal points where heavy work will be encountered, may be thus stated.

From Limon bay to Gorgona there is nothing serious, unless we except the bridges over the Gatun and the Chagres, which are, however, inferior in magnitude and difficulty of construction to bridges on nearly every important road in the United States. In passing from Gorgona towards the summit, we encounter a ridge between the Mandingo and Obispo rivers of such height as to require a tunnel of about 1,400 feet in length, involving also the necessity of a bridge of from 65 to 70 feet in height over the Mandingo river. The summit cut, mostly of rock, will average thirty-five feet in depth and two thousand feet in length; and three miles beyond this summit, a stream, called the Pedro Miguel, will be crossed by a bridge eighty feet in height, though of short span, and the embankment approaching the river will be correspondingly heavy. From this point to Panama there is no very difficult work. This enumerates all the formidable points on that part of the line which surmounts the dividing ridge of the continent; and several important works in the United States and elsewhere have encountered and overcome far more serious difficulties without hesitation. It is sufficient to instance that part of the New York and Erie road recently completed, the Baltimore and Ohio road, and the roads between Boston and Albany. On the line which I have described, the minimum radius of curvature is 1,000 feet, and there is but one curve of so small a radius. The gradients are likewise favorable, particularly in the direction of the Atlantic, towards the Pacific, the *ascending* grade in no case exceeding twenty feet to the mile; but from the Pacific towards the Atlantic there are three miles where an ascending grade of fifty feet to the mile is required. We may hence say that the "ruling" grade from the Atlantic to the Pacific is twenty feet per mile, and from the Pacific to the Atlantic fifty feet per mile, and the trains will be made up accordingly.

I have stated results on the location of the road which we have made without alluding to improvements in the details, which may undoubtedly be effected before the work of construction begins. In fact, a point has been found, at no great distance from our present summit, where the dividing ridge may be passed with an elevation twenty-four feet less than by the pass through which the line now runs. It is believed that by adopting this point as a summit, the tunnel may be much shortened, if not entirely avoided, and the fifty feet grade on the Pacific slope changed to a forty-feet grade, without increasing, but rather diminishing,

the weight of the work. The point of the dividing ridge to which I allude is but 275 feet above high water in the Pacific, and has less elevation than any summit hitherto found. It will not be difficult at the commencement of operations next season to run a line through this pass, and, in case it answers our expectation, to locate in that direction. This would have been done but for the heavy rains which fell at the time intended for the work, and the arrangements which had been made for the return of the party by the Crescent City, which was advertised to leave Chagres on the 31st of May. From our present knowledge of the country, I feel confident that the proposed summit will answer our most sanguine anticipations.

The material of the excavations will very probably be found to consist of red clay or trap rock; occasionally, it is true, we may meet alluvial sand or rock less difficult to work than trap; but there can be no doubt that, as a general rule, the earth and rock will be as I have stated. Stone fit for masonry is, I think, abundant; lime may also be obtained on the isthmus; but hydraulic cement will most probably be imported, at least at the beginning of the work. Sand must be sought for in the beds of the streams, and I fear cannot be found in sufficient quantity without much trouble and expense, especially between the summit and Panama, where it is certainly very scarce. It is probable that brick may be used to advantage, and the material for making them, as well as fuel for burning them, is found everywhere on the line. Between the Chagres river and Panama the amount of masonry required will be greater than is usual on works of similar magnitude in the United States, but of about the same character of work as is used in the northern States. Timber for *all purposes* of construction is abundant, and of excellent quality. Trees, from the size suitable for cross-ties to those of the most magnificent dimensions, abound on every portion of the line.

As regards the termini of the road, the precise points are not yet selected; though it is known that Limon bay, on the Atlantic coast, and the bay of Panama, on the Pacific, present opportunities for such selection which will secure all that is desirable for those purposes. The former is six miles east of Chagres, surrounded by highlands, and is as healthy as any place on the isthmus. It is very capacious, with deep water and good anchorage; safe even now, and capable of adaptation to all business purposes by inexpensive works. No breakwater is necessary to its safety as a harbor, and it is sufficiently commodious for all purposes of commerce for a century to come without resorting to artificial constructions, except in the building of wharves to facilitate trade. Good and abundant water may be obtained in the vicinity of the bay, and I am not aware of the want of any points of excellence which recommend our best harbors. In reference to its advantages as a harbor, I have the honor to transmit letters from Capt. D. B. Porter, U. S. N., and from Capt. Tucker, of the steamboat Orus. The opinions expressed by these gentlemen are, I know, entertained by Capt. Ringgold, of the navy, and are confirmed by a gentleman

formerly a captain in the Colombian navy, who has long been familiar with this coast.

On the Pacific coast, the character of the bay of Panama is well known, partaking in an eminent degree of the nature of the ocean so well named "Pacific;" storms rarely occur to ruffle its placid waters, and tempests are unknown. The beautiful islands in this lovely bay afford great facilities for commerce; Taboga, particularly, possesses an abundant supply of pure and delicious water, falling in cascades near the shore, from which the largest vessels may be watered in a few hours, when the necessary fixtures are erected. It is true, the waters of the bay near the shore of the main land are not sufficiently deep to allow vessels to lay alongside, and until proper works are erected the business must be done, as heretofore, by lighters; but a minute examination has been made of the harbor, with reference to its improvement and connection with the railroad, and the conclusion I have come to is, that by a judicious system of works, involving no contingency as to their practicability and success, a harbor may be made at the very terminus of the road, of ample magnitude and depth and safety, offering advantages not inferior to any on the whole Pacific coast. When this improvement is effected, vessels may be rapidly discharged at the immediate terminus of the road. It is true that, to secure this object, the outlay will be large; but the terms of the charter are so liberal, and the great amount of business so certain, as to put the question of profit on the investment beyond a contingency.

On the question of *health*, I consider the adverse accounts have been much exaggerated; such of the inhabitants as live here in the *manner of civilized beings* enjoy as good health as the people of the north, and, of the great numbers of emigrants who have passed over during the present season, but few have suffered from local diseases. Now, considering the exposure to which they have been subjected, the loose habits of many of them, *their long detention on the isthmus*, and their constant excitement, it is a proof of salubrity that so few have suffered. At present, such is the mode of life of the natives from Chagres to Panama, that there is scarcely a tenement fit to give protection to a weary or sick traveller; and, I believe, with what we call the ordinary means of protection against the consequences of exposure, and good medical attendance, *health may be preserved very thoroughly*. A small expenditure in the erection of houses, or shanties, for the employees and operatives, (which should be provided with floors, and divided into apartments,) would secure health and produce economical results.

The supply of labor for prosecuting the work is a question of some difficulty. The isthmus itself will not furnish the requisite number of efficient laborers. Those who live in the immediate vicinity of our line—which is also the route of emigration—have been completely spoiled by the opportunity for imposition which they have had (and on which they have fully practised) in the transportation of luggage and stores for the emigrants. It is not improbable that, before the beginning of the work of construction, this

business of transportation will be so arranged as to take from the laboring natives the monopoly they have enjoyed, and so save the thousand vexatious impositions and delays to which the emigrants and the surveying party have been subjected. When this is done, it is probable that a population from the remote part of the isthmus, and other provinces of New Grenada, will come in to labor; I think we may calculate safely on from three to four thousand from these sources. St. Domingo, Jamaica, and other West India islands, and also Honduras, must be looked to for the balance. An experienced contractor, from the works of the State of New York and Canada, has suggested the employment of French Canadians also.

The natives from Honduras will be very useful in all that relates to work in wood clearing and grubbing; for instance, making cross ties, hewing timber for construction, &c., &c. Besides this matter of the difficulty of procuring labor, there are two other serious impediments to the progress of the work: first, the labor of transporting materials from point to point, on account of the want of wheel roads and bridges; second, the want of all kinds of manufacturing establishments, saw mills, iron works, and shops for the practice of the most common handicraft arts, are either unknown or most miserably inefficient. These must all be established in connection with the work itself. The introduction of the portable horse power, now so common in the United States, or the steam engine, I consider to be a matter of almost absolute necessity. It is no less true that a wheel road for the purposes of the work, from the head of navigation on the Chagres to Panama, would be of immense benefit, if not indispensable.

I consider that the work may be prosecuted nine months in the year to advantage; it is doubtful if the months of September, October and November will admit of its continuance, excepting on certain kinds of work, such as tunnelling, rock excavations, stone cutting, &c.

Without attempting in this letter to give the details of an estimate, for which we have merely collected and not digested the materials, I will state—taking the cost of works at home as a standard, (but with a due regard to the amount of work per mile on each,) calculating also for the necessary buildings and depot accommodations, and such preparations at the terminus as are necessary to *commence* business, considering also the various drawbacks I have mentioned—that I judge a single track road may be built for about $3,000,000; that for $1,500,000 more, excellent harbors may be built, not for the business of the *road only*, but for all purposes of general commerce, having besides the advantage of healthy localities, with high grounds, and fresh water in close proximity. In fact, a great improvement might be made in the bay of Panama for $500,000; but it would, of course, be much less perfect and convenient than the plan above suggested. With a view of attracting to Panama the great and increasing trade of the Pacific, I would give my decided preference to the more expensive structure.

It must be understood that our conjectural estimates have been based on the project of making the road as perfect *in every respect* as the nature of the country will admit, looking to the great ends of commerce and the easy transit of travellers across the isthmus.

The question of revenue it is almost unnecessary to discuss; the bearing of the work on the grand interests of the commercial world is so apparent, and its utility so evident, as to make it certain that it will be used almost immediately on its completion to the extent of its capacity. In connection with this subject, it may not be inappropriate to remark, that over $2,000,000 in specie were transported over the isthmus in the month of May last.

If a less perfect and more economical road, in regard to first cost, should be deemed desirable, we have only to modify the gradients and curvatures, the character of the masonry and bridges, and the weight of the superstructure, to attain the result. If it should, for instance, be considered expedient to construct a way from Gorgona to Panama for horse power alone, with a lighter superstructure, it may be done for $400,000, or $500,000 *at farthest;* but this would, of course, be an imperfect road, adapted to the transportation of passengers only with their baggage, and would answer no great object of commerce, nor would it *aid* in the future construction of a more perfect work on the *same ground.*

It should have been stated, and I take the opportunity before closing this letter to say, that the entire length of line from the Atlantic to the Pacific, when the whole shall have been carefully revised, will not exceed forty-six miles. The total amount in miles surveyed for the purpose of obtaining that line, I find, on examination of the work done by the different parties, is 346¼ miles. This is independently of the reconnoissances made by myself and the chiefs of divisions, which were numerous and extensive.

You will, of course, gentlemen, understand that this is merely a hasty preliminary exposé, in which it would have been impossible to embrace the many important questions and great principles with which the work is invested. These discussions must necessarily be postponed for the final report.

Very respectfully, gentlemen, your obedient servant,

GEO. W. HUGHES,
Chief Engineer, Panama railroad.

To Wm. H. Aspinwall,
Henry Chauncey, and
John L. Stephens, Esquires.

Communication from Dr. John Baldwin in relation to the Tehuantepec route.

SIR: Having resided fourteen years on the margin of the river Guasacoalco, during which period I crossed the isthmus of Tehuantepec more than fifty times, and examined the country with a practical eye; without arrogating to myself anything, I am free to say that I possess more practical information in relation to the transit of the continent at that place than any other citizen of the United States, and frankly communicate to you my opinion, which is founded on practical experience.

The mouth of the river Guasacoalco is situated on the extreme southern bight of the bay of Mexico, in 18° north latitude. The bar is unchangeable, and of very easy entrance at all times. At low tide, vessels drawing over 12 feet cannot enter the bar; the tide raises about 18 inches once every lunar day. The severe north winds, which pervade the Atlantic coast of Mexico seven months in the year, pile up the water at the bar of Guasacoalco some three or four feet, and facilitates the entrance of sailing vessels. The navigation for ocean vessels extends up the river to Minatitlan, about 18 miles from the bar or mouth of the river. The department or jurisdiction in which Minatitlan is situated contains a population of near forty thousand persons, who are principally devoted to agriculture and pasturage. Many large herds of cattle are grazed in the department. On one estate alone, 80,000 head of horned cattle, and 20,000 head of horses, are found. Corn, sugar, coffee, and cocoa are produced in great abundance. The forests abound in live oak, mahogany, Spanish cedar, xabia, mozal, paque, lignum-vitæ, and other valuable timber for construction. The climate is healthy; the land is rolling and exceeding fertile. From Minatitlan, which I consider is the head of ship navigation, the general course of the river is south, and, for all the purposes of navigation, may be compared with the Ohio river below Pittsburg. Steamers, of the construction of those used on the last named river, could ascend, at all seasons of the year, to the landing above the mouth of Sarabia, an affluent of the Guasacoalco, 17° north latitude, and about 120 miles from Minatitlan. From Sarabia to the Pacific coast at San Mathews is fifty-five miles, nearly due south. No direct road has been opened between these two places. The route of travel at present used zigzags from village to village, for the general convenience of the inhabitants. A dense forest of eighteen miles must be traversed to reach a village called Boca del Monte, or San Gabriel. The road enters a rolling prairie country which continues to the Pacific coast. From San Gabriel to San Juan Huichicovi is twelve miles; this village contains about seven thousand inhabitants, (Mijes,) who are almost entirely agricultural in their pursuits. Their principal wealth consists in mules; of which useful animal it is said they have at least 10,000. Hitherto the road has been nearly west; in proceeding it diverges to the southwest for twelve miles to Santa Maria Pitapa; from thence two miles to the Barrio. The base of

the mountain is two miles from the Barrio, and is about six miles across. At the southern base of the mountain runs the river of Dogs, *Rio de los Perros*, near to which is the village of Huichitan; from thence to the city of Tehauntepec is fifteen miles of level road. The city of Tehuantepec is about five miles distant from the Pacific ocean; contains about 9,000 inhabitants. A large river runs through the city; the houses are constructed with stone and lime.

The jurisdiction of Tehuantepec contains about 30,000 inhabitants. The land is cultivated by irrigation, and yields abundantly; three and four crops of corn can be grown in a year upon the same ground. The inhabitants are generally mixed blood—Spanish and Zapoteco—docile, peaceable, temperate in their habits, kind, and hospitable; the men active and well formed, and the women handsome. Indigo is the agricultural staple of the vallies, and the adjacent mountains produce cochineal, which, together with dried fish, shrimp, leather, saddlery, harness, and shoes, comprise their principal exports. An extensive bank of pearl oysters is found about 30 miles from the city.

The port of Tehuantepec is a few miles east of the mouth of the river. The bar is about a mile wide, and enters into a large lake, or estuary, called San Francisco, which is some ten miles wide, and twenty long; depth from five to ten fathoms. I never could find a boat of sufficient size to justify the attempt to sound the bar, and cannot, therefore, say anything positive in regard to the depth of water. The climate of Tehuantepec is the most agreeable of any part of Mexico. The prevailing winds are from the north, and make the offing a secure roadstead for at least ten months in the year. The rainy season commences in June, and lasts about six weeks; the rest of the year is perfectly dry, which makes the country very healthy. Notwithstanding the thermometer never indicates less than 80 degrees, there is no dew, and the horizon is unclouded for months in succession. Provisions are abundant, and cheaper than in almost any other place on this continent. Beef, one cent. per pound; corn cakes, (tortillas,) two cents per lb., &c. &c. The usual price of labor at Tehuantepec is 25 cents per day, out of which the laborer finds his own food. A slight increase in the price of labor would attract thousands to any public or private enterprise.

The cordillera or mountain is, although abrupt on either side, an open prairie, or covered with grass. A few scattering pines are seen on the eastern slope. The crest of the mountain for several miles barely affords room for a horse path. At one particular place, a stone may be rolled from the mountain crest into a branch of the Malatengo, an affluent of the Guasacoalco, on the north; and from the same place into a branch of Dog river, Rio de los Perros, on the south. A tunnel of 800 or 1,000 yards would commingle the waters of the north with those of the south.

On the north side of the isthmus, the value of labor is 37½ cents per day. A trifling advance on the customary price would attract thousands of laborers, who are fully acclimated, and would do a

fair day's work. I have no doubt that, if a railroad was being made across the isthmus, six or seven thousand laborers could readily be obtained. Wood of the most imperishable kind can be found for cross timbers. Spanish cedar, mahogany, and pitch pine in abundance for steamers or string pieces.

With the aid of a steamboat on the Guasacoalco river, the isthmus of Tehuantepec might be traversed by passengers in 36 hours at this time; and if a straight road was opened from Sarabia to the point of embarkation on the Pacific, the trip could be made in from 24 to 28 hours.

If a railroad communication should be projected, propriety would seem to require that it should commence at the head of steamboat navigation. When finished, from thence to the place of embarkation on the Pacific, both passengers and merchandise could be carried across the continent in 15 hours, which would place New Orleans within five days of the Pacific ocean, in north latitude 16° 5′. From thence to San Francisco in California is about 2,200 miles, or nine days' steaming, making from New Orleans to San Francisco only 14 days.

The construction of a railroad requires time, whilst we, the people of the United States, desire to know and have opened to us the shortest, safest, and, consequently, the cheapest best line of communication to our Pacific possessions. If the government of the United States will obtain from Mexico the right of transit for our citizens, I am free to say that passengers can and will be conveyed from New Orleans to the Pacific coast in less than seven days; and thus San Francisco will be immediately brought within sixteen days of New Orleans.

Yours, with respect,

JOHN BALDWIN.

Hon. J. A. Rockwell, *M. C.*

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